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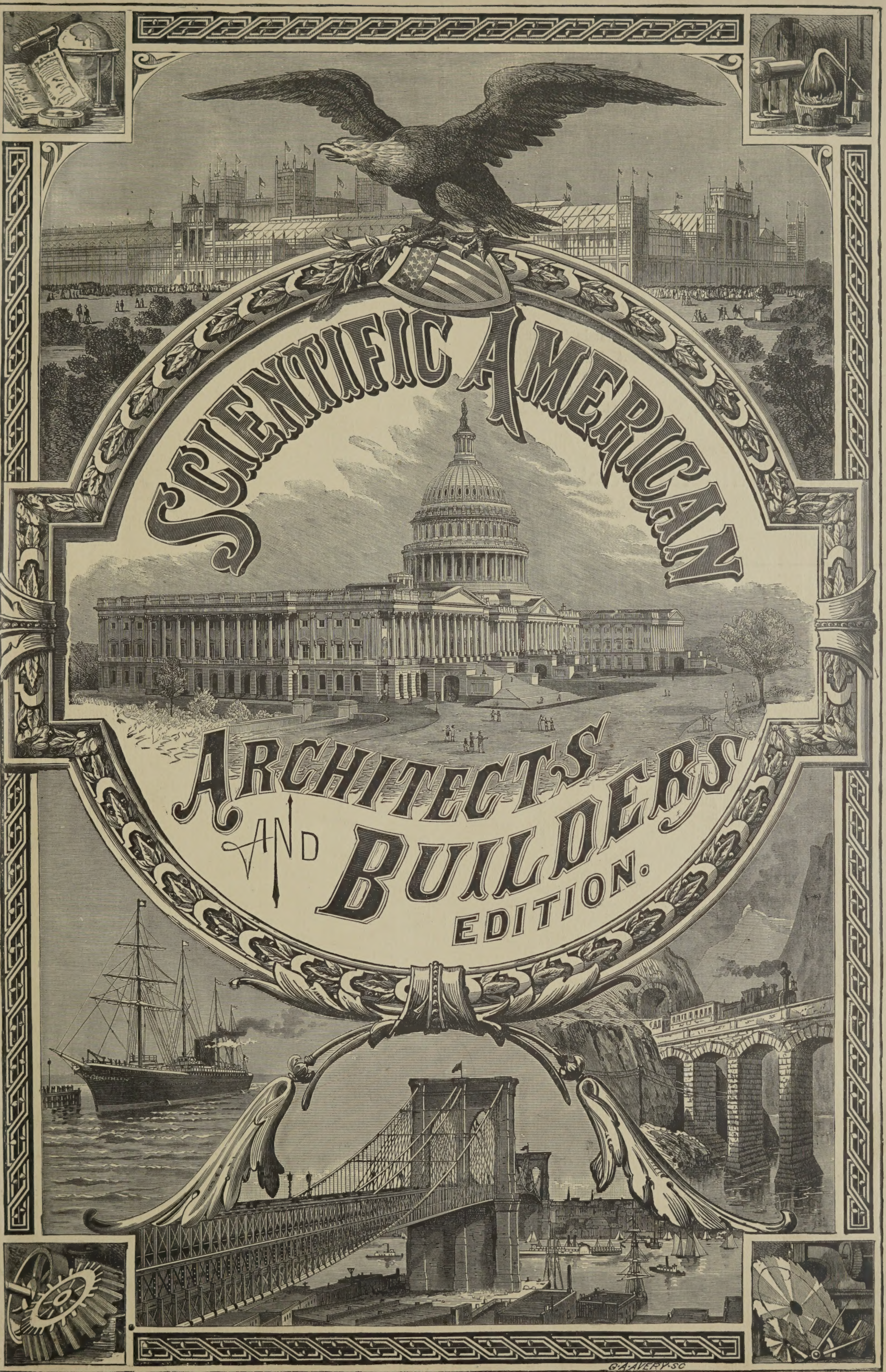

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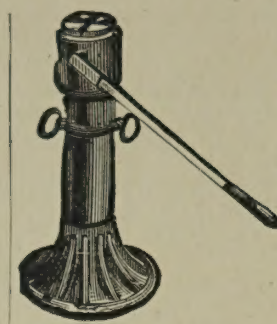

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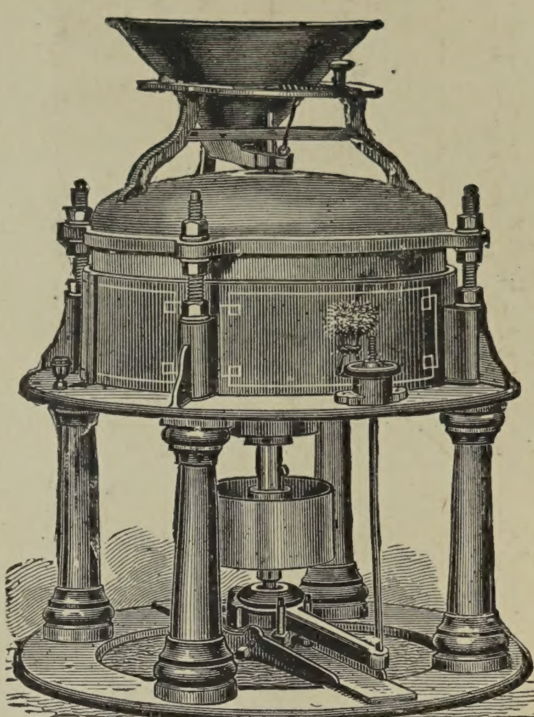

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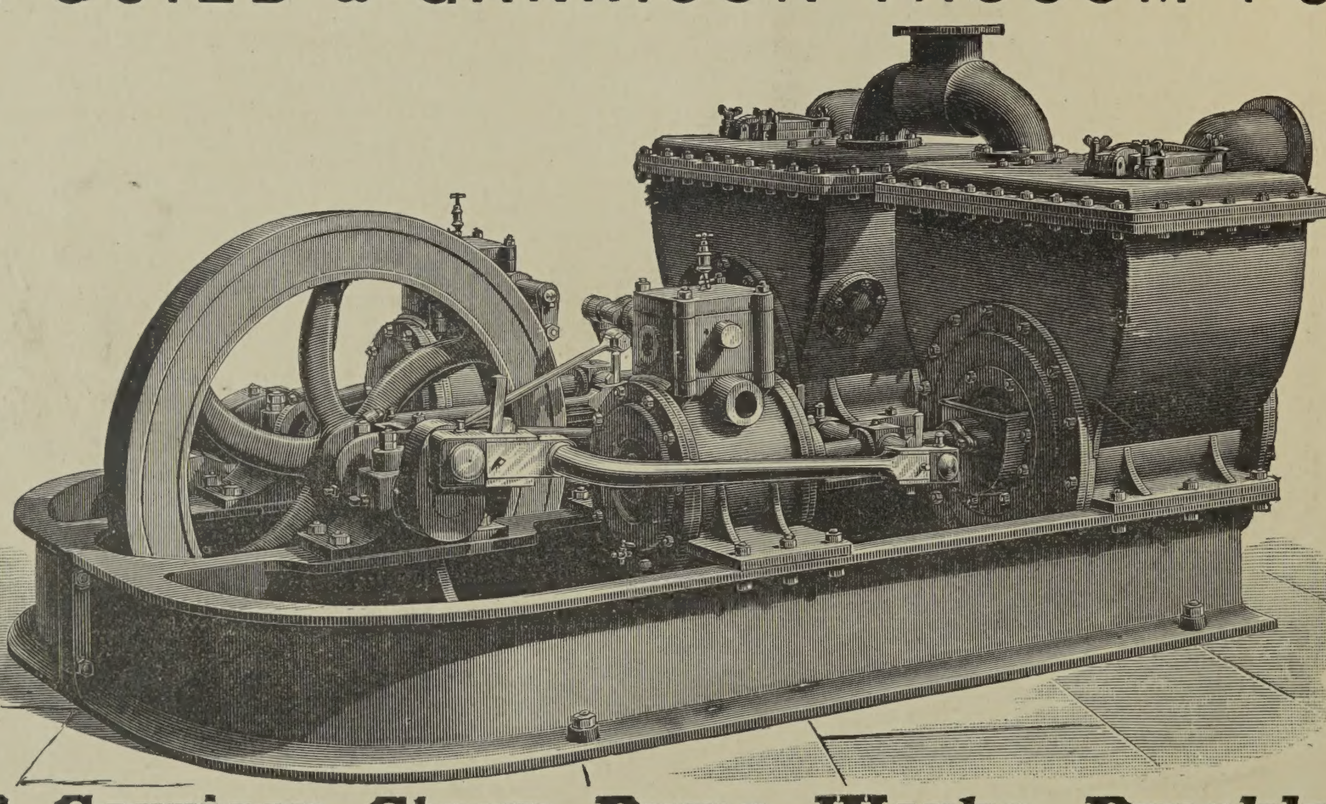

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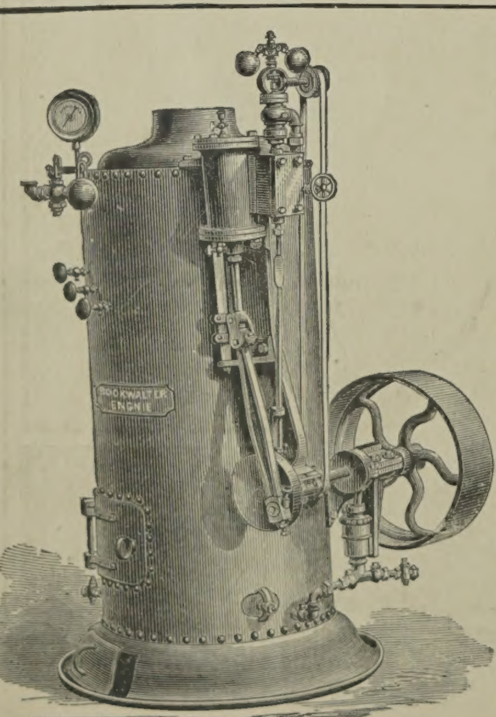

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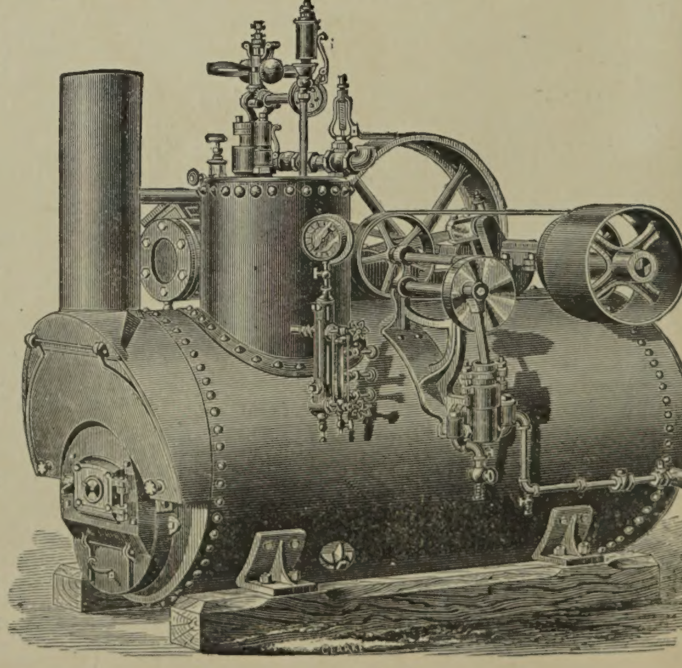

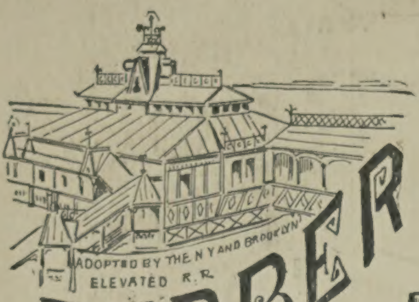

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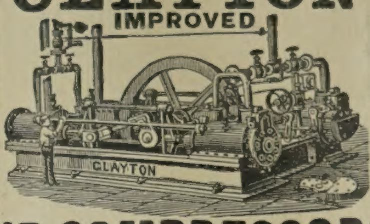

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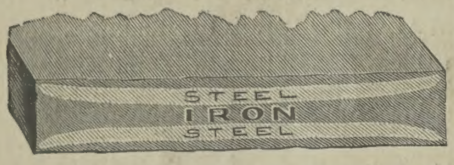

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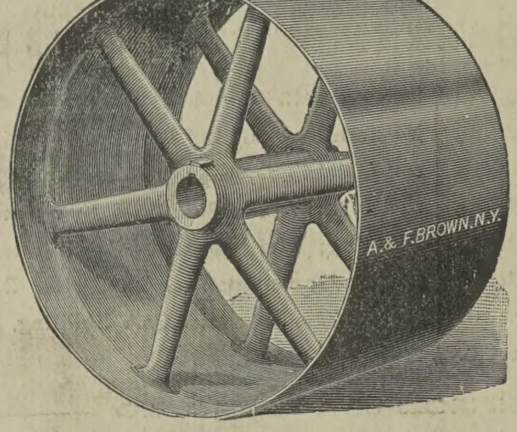

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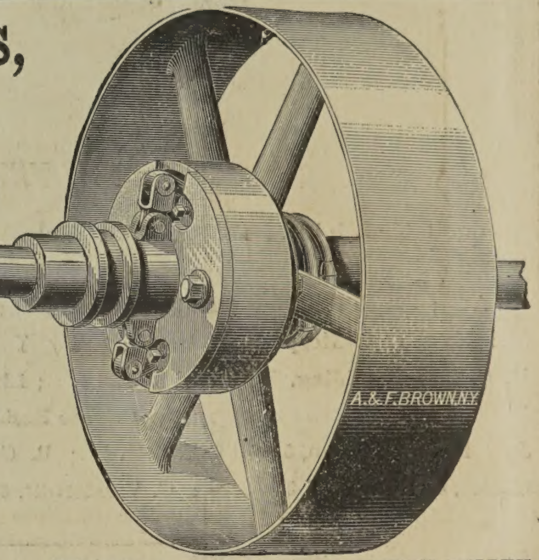

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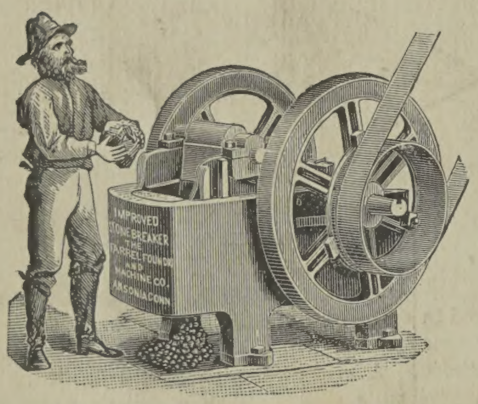

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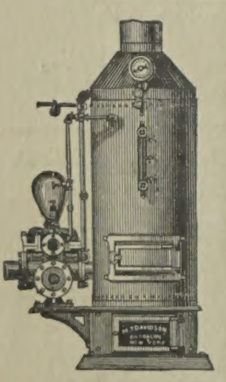

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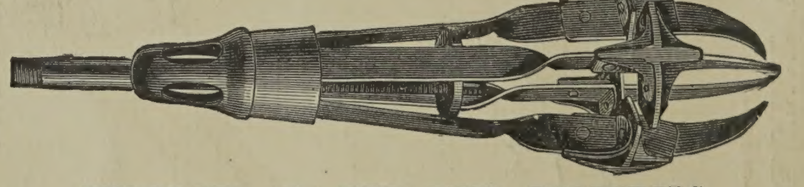

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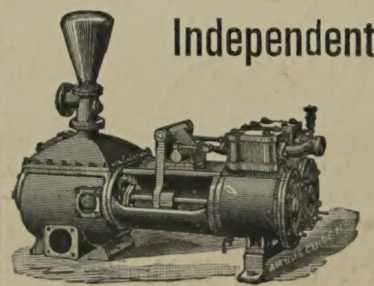

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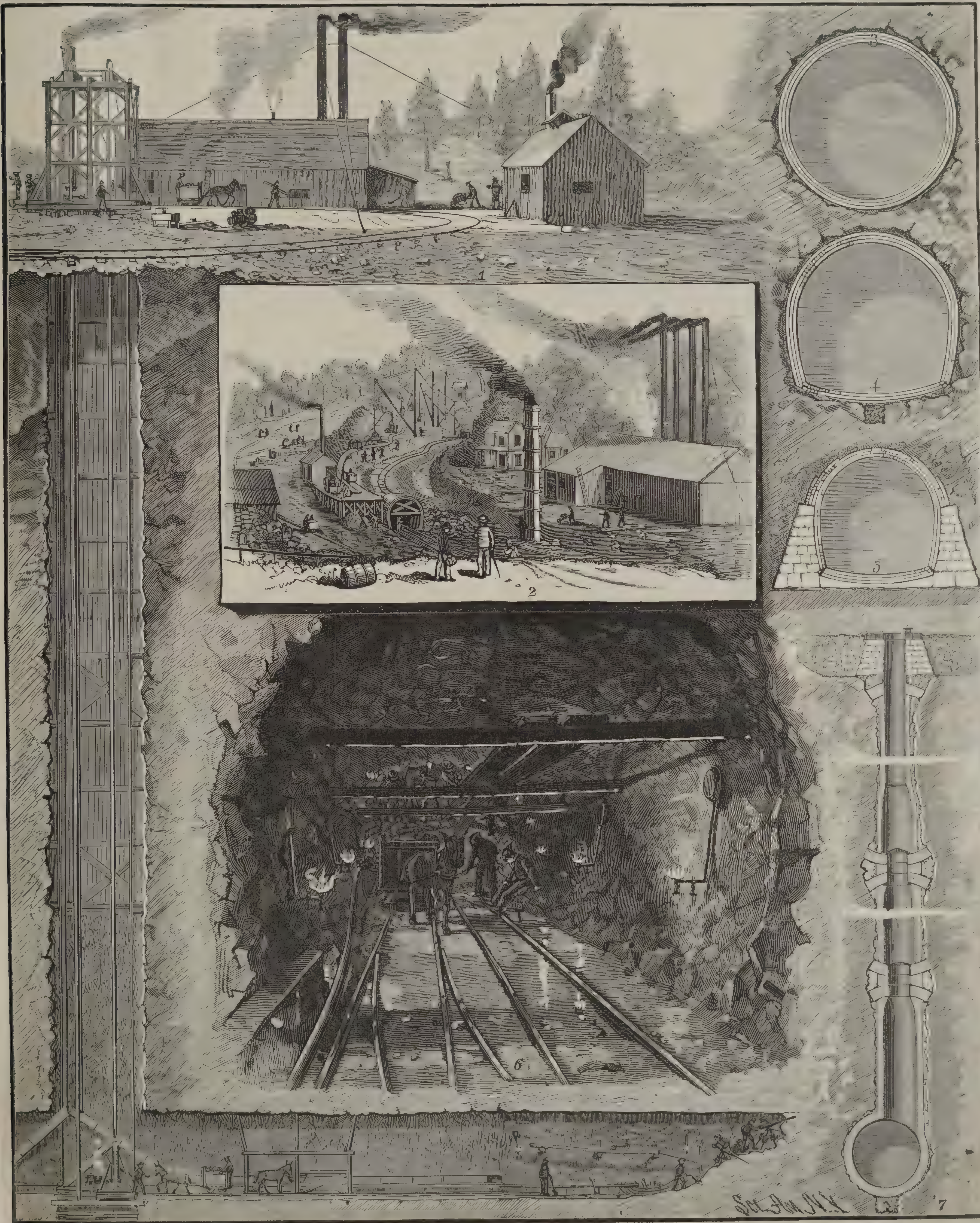

THE NEW AQUEDUCT TUNNEL FOR THE CITY OF NEW YORK.—[See page 7.]

Scientific American.

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O. D. MUNN. A. E. BEACH.

NEW YORK, NOVEMBER, 1885.

Contents.

Of the November number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.
(Illustrated articles are marked with an asterisk.)

Table of Contents of

THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 514,

For the Week Ending November 7, 1885.

Price 10 cents. For sale at this Office and by all Newsdealers.

GOVERNMENT INVESTIGATION OF THE BELL PATENTS.

The Bell telephone patents seem to be peculiarly favored by fortune. After adverse action by the circuit courts, their opponents sought the aid of the government, endeavoring to make it assume the role of public prosecutor, so as to decide the validity of the patents finally on their merits. The Attorney-General's department was manifestly the proper one to prosecute the case. But on reference to him, it was found that he owned some outside telephone stock, was therefore interested in the defeat of the Bell patents, and so could not properly act as prosecuting officer. Hence a suit that had been begun by his subordinates, and which was started on such a basis as would, if anything has that power, insure the full trial of the case, had to be discontinued. Their fortune did not desert the Bell Company. The most menacing suit ever instituted against them was stopped.

It is of imperative necessity to the public that these patents be impartially investigated by a competent tribunal. The suit just discontinued was a public need. What the Attorney-General's duty is in the matter is hard to say. It would seem asking too much to suggest his resignation. If, while owning stock in an adverse company, he was to prosecute the suit, public opinion would be clamorous against him, would make him waver in his action, and would unquestionably bias the mind of the court strongly against him. He might sell his stock, but even if he did so, he would still appear as one working for the cause of his friends. The ownership by the public prosecutor of a few shares of telephone stock has become lifted into the dignity of a national misfortune.

The rejection of Morse's claims to the transmission of signals by electricity is historic. He was trying to patent a natural force. The patentee of the telephone has in effect done this very thing. His claim as construed by the circuit courts covers the transmission of articulate speech by electricity. His lawyers, with wonderful ingenuity, have captured the minds of the judges. They have evolved a theory of an undulatory current, and of corresponding movements of the two telephone diaphragms, that they can stretch to cover any electric telephone. A point of such abstract theory as this is made one of the central features of their defense. The probability that there is no such thing as an electric current, the incapacity of an induction coil for generating a continuous current in any sense, the probable inoperativeness of any undulatory feature that may be accidentally present in telephone currents, are all lost sight of, or cleverly evaded, and the fiction of an undulatory current is kept up. A number of suits have been decided on final hearing by the circuit courts, and always with the same result, a victory for the patents. But just as inevitable as the result was an incompleteness in the issue as presented. The defendants always made admission of some of the points of attack. Infringement was admitted in one case, claims of other inventors were left out in others. The question of validity never yet came to trial upon its merits. At last, in the western district of Pennsylvania, such a case came up on motion for preliminary injunction. Every effort was made to meet the motion by a full defense. All the points that could be raised against the Bell patents were to be used. Even a series of Reis and other telephones were prepared for exhibition, and personal auricular trial by the court to prove anticipation.

The case was opened by the patentee's counsel, in an elaborate address, lasting several days. After the opening had been only commenced by the defendants, the judge announced that he should in any case be guided in his decision by what his brethren of the circuit courts had already done, and should grant the injunction. This action was taken in the face of the fact that a new set of issues, because a complete set, were open for the judge's consideration. Of course in the normal course of things the suit will come eventually to a final hearing, but the treatment of the elaborate and full resistance to a preliminary injunction is a good illustration of the remarkable prestige held by the owners of the Bell patents. From the character of the counsel and capitalists engaged and interested in this suit, much may yet be hoped for from it

Distinct allegations of fraud in the granting of the Bell patents bring them within the province of action of the Attorney-General. He could have tried the case in the circuit and eventually in the Supreme Courts, as no one else could. The action would come from such a new quarter that the circuit court judges would be to a greater or less extent free from the influence of former decisions. A way seemed to have been found in which to try the case *de novo*, upon its merits, unaffected by decisions in other cases. Unfortunately, it had to be abandoned.

The natural tendency would be to look to the Supreme Court for the remedy. The Bell patents have never appeared before that tribunal. When they do, in the natural order of the different suits, the first decisions will be rendered upon incomplete issues. Before a full presentation of the case is made, the Bell Company in every probability will have secured several Supreme Court decisions. Each of such decisions will make the ground of attack doubly hard for the next suitor. Thus it appears that there is little chance for a decision that will be satisfactory, because a complete one, for many months; and when the time for such action arrives, the court will quite probably have behind it and be guided by a series of decisions in the patent's favor. All this shows how well the case has been engineered by the eminent counsel retained by the Bell Company. The patent, in itself, is far from being the basis of the prosperity of its owners. It has not merit enough in it to give it that position. But a combination of great business with great legal talent has made it the cornerstone for an unprecedented structure. One hundred millions of dollars at the time of the hearing of the Drawbaugh suit was commonly assigned as the value of the interest. Since that period it has certainly increased in value and in apparent stability. This immense monopoly rests on and is based on the theory that in all telephone systems speech is reproduced by "an undulatory current of electricity." A more slender basis, owing to the absence of a rational theory of electricity, could not be imagined.

The Department of the Interior has at last taken cognizance of the state of affairs. Secretary Lamar and Commissioner Montgomery are to have the counsel and representatives of several telephone companies appear before them for the consideration of the following questions: 1. Has the government a right to institute proceedings to set aside the Bell patents? and 2. If so, are the facts such as would warrant the bringing of such an action? If the questions are decided in the affirmative, and the Attorney-General is requested to prosecute, he will do it more gracefully than before, but still will be overshadowed by his ownership of telephone stock. The courts will be influenced in favor of the Bell patents by it, just as was feared in the discontinued suits.

"THE DOLLAR MEDICAL SHOP."

Expenses for medical services form an important item in the family account of the artisan and the workingman. A growing family has many aches and ailments, which, not being understood, seem the more serious—hence the physician and his bill.

There is reason to believe that not once in five times when the physician is called to attend one of these families is his presence required. A simple remedy that the more intelligent would quickly have bethought themselves of is prescribed by the physician, and the pain is stopped. But his bill goes on. The items increase and multiply, and his services, like good seeds sown in the ground, bring forth their fruits in their season, his crop ripening at the end of the year. Unhappily, the physician has no regular system of prices. Sometimes a poor family is charged only two dollars for a single visit, but usually three, and operations, even of the most simple description, are often charged for according to what the patient is supposed to be able to pay. The apothecary may also be regarded as an unknown quantity. The wind, we are told, is tempered to the shorn lamb, but the apothecary knows no such merciful rule. He gets what he can, and in the getting has little regard apparently to what the article costs him. Those familiar with the market price of drugs and simples have often been pained and surprised to see him charge sixty cents and even a dollar for what could scarcely have cost him so much as a shilling.

This indefinite system of charge is a serious matter to the workingman with a family. If a rash breaks out on the baby, it costs him three dollars for a physician, and perhaps sixty or eighty cents for medicine; and if Mary Jane be suddenly taken with chills, several visits and prescriptions are presumably required, which between physician and druggist mayhap cost the poor man a week's earnings.

Attempts have been made to protect the workingman with a family from these impositions. Some of the workingmen's clubs connected with the churches employ skillful and reputable physicians, who give their services to members at nominal prices. The most successful attempt thus far to protect poor families is perhaps that of the directors of the New York Hospital, who have established an out-patient dispensary, where, for a fee of only one dollar a month, a poor family may have twelve consultations during the same period; the prescriptions that are made up costing from ten to twenty cents extra. The physicians employed at the hospital, where all consultations take place, are, in all cases, the most skillful practitioners in the city, the medicines and drugs are the best, and the prescriptions carefully compounded.

Experience has shown that this system is much to be preferred to that of the public dispensary, because the dollar a month fee keeps away the malingerer and the tramp, and, better still, does much to remove the feeling of alms-taking, which it has been found is so repugnant to many worthy and deserving people as to keep them away from the public dispensary.

It is much to be regretted that this out-patient department of the New York Hospital has excited the open hostility among a certain class of the medical

profession, who, forgetting the advantages it offers to the poor, seem inclined to look only to the fees which are lost to the physician.

In a recent editorial in the *Medical Record* on "The Dollar Medical Shop," a writer says: "As is learned from the annual report of the year 1884 (of the New York Hospital), 5,169 persons availed themselves of this imposition during that year, and the total number of visits was 27,565. . . . *No encouragement should be given to this class, who seek to evade their dues to physicians.*"

The italics are ours.

This is assuredly an extraordinary view of the matter. Is there any class of the community which is under obligation to pay over a certain amount in "dues" to physicians? And is it an injustice to these physicians if a certain number of possible patients combine together to protect themselves against extortion and malpractice? Certainly not.

If the writer of this article in the *Record* had shown that the subscribers to this dispensary were not properly treated and could not be properly treated under the conditions, then surely he would have done something to make out a case. But, as it is, he argues only for dollars and cents, and against the interests of the poor patient. Continuing, he says: "If the present abuse be not soon checked, it may be that each physician will have his own dispensary, that is, treat people free at his own office during certain hours. In that case, the dispensaries would soon find their occupation gone, and their spheres of usefulness properly narrowed."

Now, if physicians should treat the poor free at certain hours as suggested, they would be doing no more than many eminent French physicians like Ricard and German physicians like Trubmann have done before them; and should such a condition of things come to pass, and the public dispensary, as the writer prophesies, find its occupation gone, the projectors of these admirable institutions will at least have the satisfaction of knowing that they brought about a very desirable change in the treatment of the poor sick.

The Soil as a Filter.

The conclusions from experiments made by the National Board of Health of New York, and conducted by Raphael Pumpelly, corroborate the opinion of every sanitarian in this country, that though natural soil is an excellent filter for impure air that may pass through it, it is a poor filter for infected water. The experimenters say: "From these results it appears that sand interposes absolutely no barrier between wells and the bacterial infection from cesspools, cemeteries, etc., lying even at great distances in the lower wet stratum of sand. And it appears probable that a dry gravel or possibly a dry very coarse sand interposes no barrier to the free entrance into houses built upon them of these organisms, which swarm in the ground air around leaky drains," etc. Other experiments have shown that ground air will take up infectious germs from water that is disturbed.

The Ticking of the Clock.

Slight though the ticking of a clock may be, says a writer, its sudden cessation has a wonderful influence upon the inmates of a room in which the time keeper is located. A dim realization of something wrong steals over the senses—a feeling as if something of value had been lost, or a friend had gone away perhaps never to return, or as if some of the children were sick, until suddenly one looks up and exclaims, "Why, the clock's stopped!" And immediately the ill-defined forebodings dissipate, the little shadow of gloom melts away, and as the winding up process is completed and the cheery ticking recommences, the family circle regains its wonted buoyancy of spirits, and the members wonder what it was that made them feel so gloomy a few moments before.

Improvement of the Ohio River.

The Davis Island Dam was formally opened on October 8. This dam, on the Ohio, six miles below Pittsburg, Pa., designed to maintain a navigable stage of water at that city the year round, was begun August 18, 1878, and since then, with many interruptions and delays, the national government has spent nearly $1,000,000 on the structure. The dam's distinctive feature is its movability. It is in reality 300 little dams, each so hinged that it can lie prone upon the river bed. This line of movable dams, or "wickets," extends the entire distance across the river, 1,223 feet. Of this distance, 559 feet only is the navigable pass or pathway for all craft when the lock is not used. The rest of the dam is designated as "weirs," of which there are three, divided by solid piers of masonry. To raise the wickets of the navigable pass, a "maneuvering boat" is used; to raise the "weir" wickets, a "surface bridge" is called into play.

Like the wickets, this bridge lies upon the bed of the river when not in use, and is raised and joined section by section. To raise the wickets and tilt them into position, where they are retained by a prop, calls into play an ingenious device, the Pasqueau "hurter." A deft pull upon the prop dislodges it, and permits the wicket to recline upon the bed wrested from the river. Between each wicket is a space of an inch or two, which can be batted if desired, but which will probably be left open to permit the passage of surplus water.

The monster gates of the lock are closed by force generated in a turbine wheel fed by water stored in huge tanks. Each gate rolls upon its track, and when in position they form the upper and lower extremes of a lock 110 feet wide and 600 feet long; a space sufficient to accommodate a tow boat and average tow of canal boats and barges. To fill the lock requires but four minutes' time; to empty it, the same.

The great dam is experimental in that, should its success be assured, others will follow, and a series of pools will render the Ohio steadily navigable, as has been the case on the Monongahela.

FROM experiments performed by Prof. Bauschinger, of Munich, it was found that of all the materials used in columns for supporting portions of buildings, cast iron and cement concrete best endured the test of great heat, as in fires, and sudden cooling with water. Wrought iron columns failed much more quickly. Brick pillars showed great resistance, but granite, limestone, and sandstone were not fireproof.

NIGHT SKY—OCTOBER AND NOVEMBER.*

BY RICHARD A. PROCTOR.

The Dipper lies low, the pointers a little east of north. Between the pointers and Pole Star lies the tip of the Dragon's Tail. Sweeping around the Little Bear (*Ursa Minor*) we find the stars of the Dragon (*Draco*) curving back by the star δ to the Dragon's Head with the two bright eyes, γ and β. Above is the inconspicuous constellation Cepheus; and somewhat higher, the stars of Cassiopeia, α and β, marking the top rail of the Seated Lady's Chair.

Low down in the northwest, Hercules is setting. Above is the Lyre, with the bright steel blue Vega; and above that the stars of the Swan (*Cygnus*), which has sometimes been called the Northern Cross.

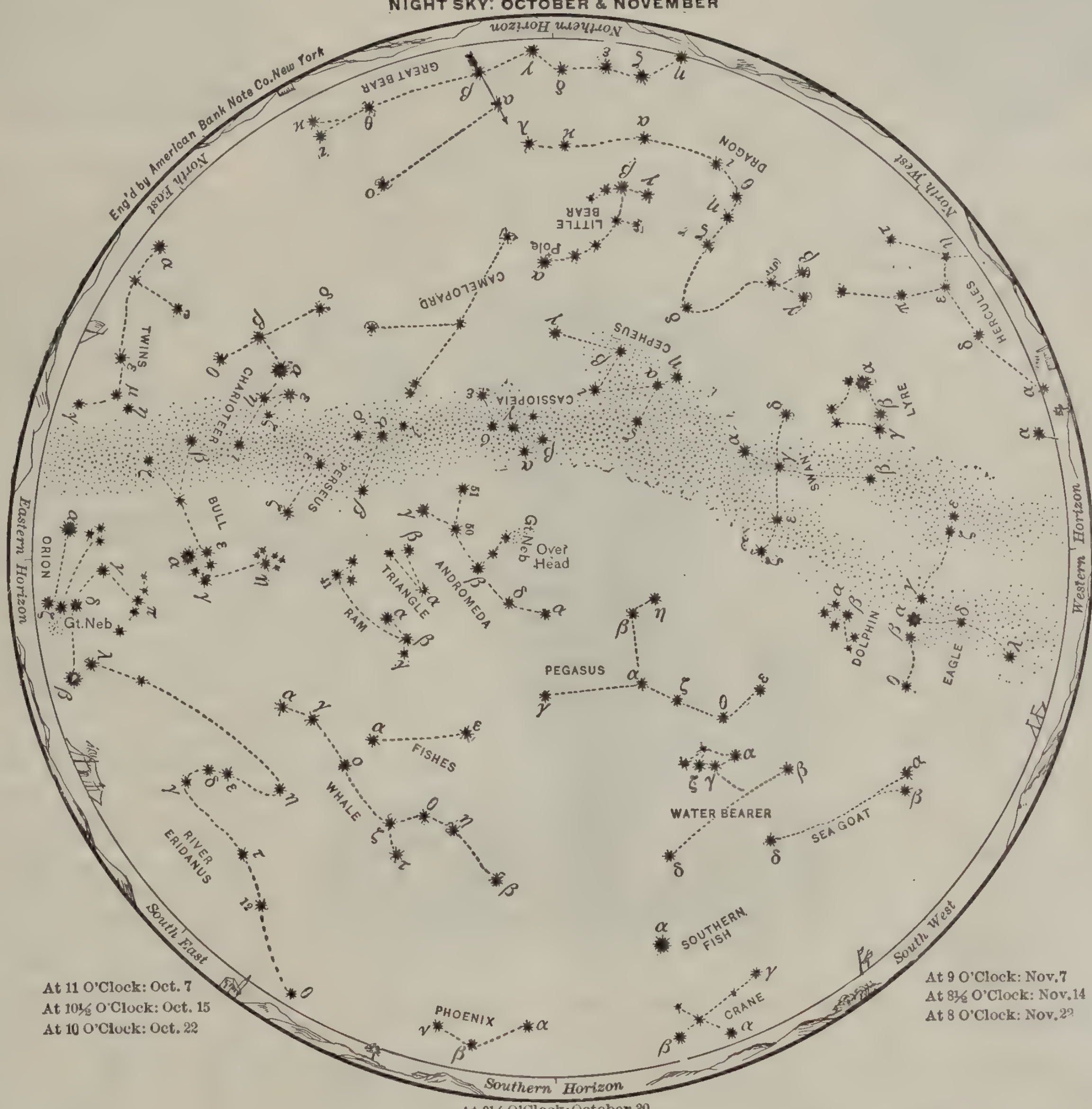
Nearly due west we find the Eagle (*Aquila*), ζ and ε marking its tail, θ the head. Above the Eagle is the pretty little constellation *Delphinus*, the Dolphin.

In the southwest, rather low, is the Sea Goat (*Capricornus*); above and to the south of him the Water Bearer (*Aquarius*), with his pitcher, marked by the stars, α, γ, and ζ. The head of the Winged Horse, *Pegasus*, now upside down (in fact, he is seldom otherwise), is just above this group. The "Square of Pegasus" will be noticed high up, due south. The star α, of Andromeda, one of the corners of this square, used to be also called δ of Pegasus.

Much attention need not be directed to the lowly Phœnix, low in the southern horizon. The River *Eridanus* is coming well into view; and the great Sea Monster (*Cetus*) now shows finely, his head at α and γ, his paddles at ζ and τ. The fishes (*Pisces*) are above, the Ram (*Aries*) above them and eastward, lying toward the southeast, then the Triangle (*Triangula*, or the Triangles, according to modern maps) and the Chained Lady, *Andromeda*, too nearly overhead to be very pleasantly observed. The great nebula in which the new star recently appeared is near the point overhead.

The grand giant Orion is rising in the east; above him the Bull (*Taurus*) with the Pleiades. Low down in the northeast the Twins (*Gemini*) are rising; above is the Charioteer (*Auriga*), and above him the Rescuing Knight (*Perseus*), "of fair haired Danae born." The Camelopard is hardly worth noticing, except as marking a barren region of the heavens.

NIGHT SKY: OCTOBER & NOVEMBER



In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

Preserving Eggs.

Now is the time the egg preserver may get in his work. In many towns, both East and West, shrewd men are packing eggs by the thousands at a cost of less than one cent each. Next winter they will sell at two cents each, when fresh eggs are 50 per cent higher. Eggs packed and treated as follows can be kept three months, and seem and look like fresh eggs:

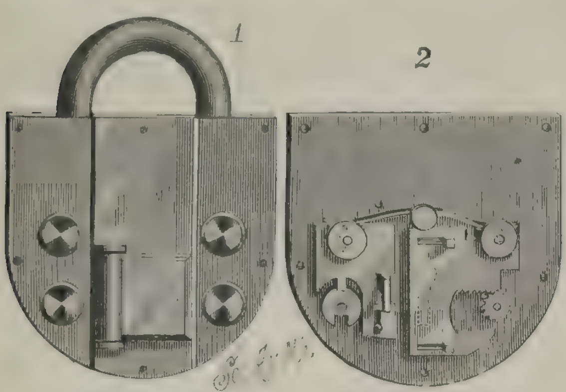
Take a common box, such as is used for packing canned tomatoes; upon a two inch layer of fresh, clean oats place the eggs, large end down, and leave space of at least an inch between the eggs; cover with a layer of oats and then place another layer of eggs as before, until the box is nearly full; fill it with oats, packing the grain in neatly and screw on the top; place your box in a cool cellar, and turn it upside down every other day. If strictly fresh eggs are used, and the turning is attended to as directed, few persons will know them from fresh eggs, and they will certainly be much superior to limed or pickled eggs.—*National Stockman.*

IN the Smithsonian Institution, at Washington, is the small nugget of gold, a little larger than a pea, that first met the eyes of James Marshall in the sawmill raceway at Sacramento, and was the beginning of those discoveries in California that have added nearly $1,500,000,000 in gold to the world's stock of the precious metals.

* For further details about the various constellations, the reader is referred to the author's "Easy Star Lessons."

AN IMPROVED KEYHOLE GUARD.

An ingeniously contrived keyhole guard, recently patented by Mr. Joseph Krejci, of Armstrong, Neb., affords a double protection against interference with the lock. In the engraving, Fig 1 shows the outside of a padlock to which the device has been applied, and Fig. 2 the interior mechanism which operates the guards. A metal door over the keyhole, and two buttons on each side of the door, are the only parts visible on the outside. After turning the key in the lock, and removing it from the keyhole, the outside door is closed, and a hook on its inner side near the free end passes through a slot in the front face of the padlock. The upper right hand button is raised to bring an inner plate under this hook, and the lower right hand button is then turned to the right to bring the shallow



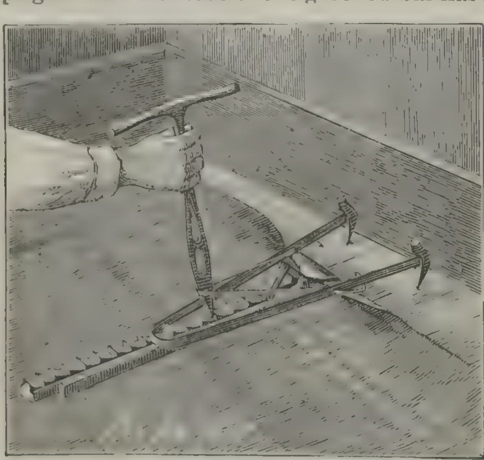
KREJCI'S IMPROVED KEYHOLE GUARD.

notch on its inner disk under a downwardly projecting lug on the locking plate. When notch and lug are opposite each other, the plate is forced down by a spring above it, and is locked in place by the engagement of the lug and notch.

The second guard is a horizontally movable plate, which may be brought over the inside of the keyhole. For this purpose, the upper left hand button is raised to disengage its inwardly projecting pin from the central notch in the top of the plate, and the lower left hand button is then turned to the right, to cause its toothed disk to engage the teeth formed in the lower edge of a recess in the guard plate, as shown in the second figure. When the plate has been moved far enough to cover the keyhole, a spring forces the pin on the upper button into a second notch in the top of the guard plate, and thus locks it in place. When it is desired to unfasten the padlock, the upper buttons are raised, as before, and the lower buttons are turned about a half revolution, but in a reverse direction. The outer door can then be opened, and as the inner guard plate has already been moved to one side, the key can readily be inserted. Although this invention is shown applied to padlocks, it is evident that it is equally applicable to other locks.

AN IMPROVED CARPET STRETCHER.

The illustration herewith plainly shows the operation of a simple and effective device for lessening the labor of laying carpets. A grooved bar is placed on the floor, and in the groove is a sliding rack, pivoted at its front end in the grooved bar. A U-shaped frame, having heads at each end, with their lower ends pointed, is held above the sliding rack by a V-shaped wire or fulcrum rod held between the open and closed ends of the frame, and this fulcrum rod is connected with the upright handle or lever. The grooved bar has at its



TAYLOR'S CARPET STRETCHER.

front end a flattened part, over which the edge of the carpet is lapped, where it is clamped by the pulling back of the lever; moving back the lever further stretches the carpet toward the wall, and the stretcher is locked in place by pressing the frame down to engage its crosspiece with the teeth of the rack, the outer ends being held by the points of the heads driven into the floor, at the baseboards. The handle, shown upright, is a hammer as well as a lever, being made in suitable tack hammer form.

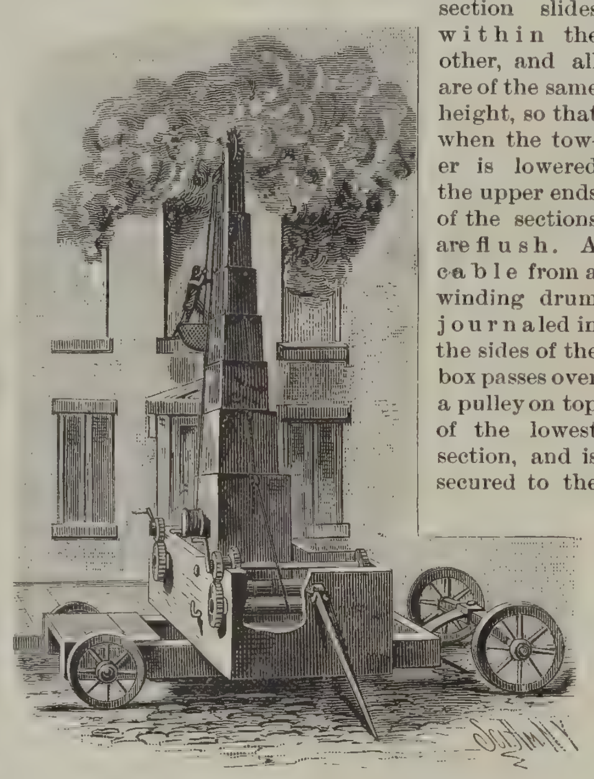
This invention has been patented by Mr. John J. Taylor, 2d, and the stretchers are manufactured by Messrs. Pickett & Rogers, of Warren, Pa.

Drying Tomatoes.

In Italy an extensive business is carried on in drying tomatoes to use during those portions of the year when fresh fruit cannot be obtained. According to the *Rural Record*, tomatoes are grown, for the most part, between rows of grape vines. Sometimes the tomatoes are trained on the lower bars of the trellis to which the vines are attached. The tomatoes are allowed to remain on the branches until they are quite ripe; they are then picked and pressed in bags made of coarse cloth, which allows the pulp to pass through, but which retains the seeds and skins. The pulp is then thinly spread out on cloth, boards, or in shallow dishes, and exposed to the sun to dry. When it has become quite dry, it is broken up fine, or ground, and put into boxes or bags and sent to market. A large part of it is used for making soups, but a considerable portion is employed as we do tomatoes when preserved in tin or other cans. It is soaked for a few hours in warm water, and then cooked in the ordinary manner. There is a great prejudice against canned tomatoes, many being unwholesome. The acid juice which they contain unites with the solder of the tin cans, and forms a disagreeable compound.—*The Garden.*

FIRE ESCAPE.

The object of the invention herewith illustrated is to provide a fire escape which can easily be transported to the fire, elevated to reach to the tops of the highest buildings, and inclined toward or from the buildings as required. Arranged to turn on the wagon platform is a box, and on one edge of the top of the base the lower edge of the bottom section of the telescopic tower is hinged. The tower consists of several sections; one section slides within the other, and all are of the same height, so that when the tower is lowered the upper ends of the sections are flush. A cable from a winding drum journaled in the sides of the box passes over a pulley on top of the lowest section, and is secured to the lower part of the second section. On the opposite side of the tower a cable is secured to the upper part of the second section, and passed over a pulley on the top of the third section, and fastened to the lower part of the third section. Cables are similarly arranged on the remaining sections. In the forked end of the upper section is journaled a pulley having spikes on its rim. On one side of this section is a pulley over which passes a rope, from one end of which is suspended a strong wire basket having one side flattened, so that it can slide up the side of a building. The other end of the rope is wound upon a drum on the side of the bottom section. The hoisting rope is placed at the hinged side of the tower; on the other side a cable is secured to the bottom section at the top and bottom, and is passed a number of times around two winding drums.



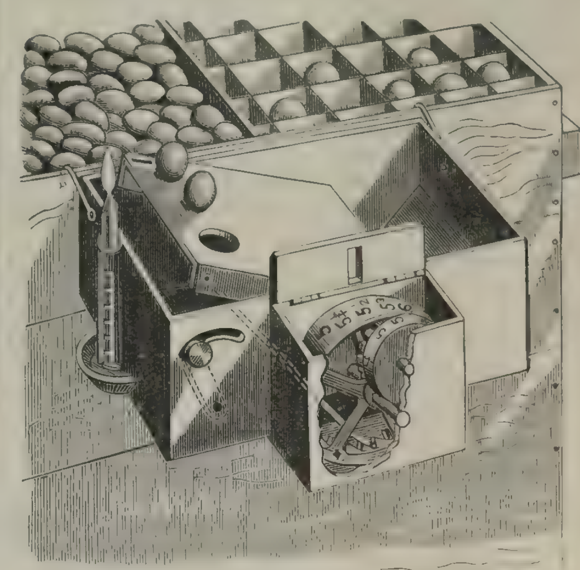
SANDBERG & AKESON'S FIRE ESCAPE.

The apparatus is simple to operate; the truck is placed in front of and parallel with the building, when the box carrying the tower is turned until the side pieces are at right angles to the building. The tower is then raised by winding the hoisting cable upon the drum; the cable pulls upward the second section, which in turn pulls up the third and so on, all the sections being raised at the same time. If desired, the tower can be swung over until the spiked pulley rests against the building; to incline the tower, the drums are so revolved as to wind that part of the rope connected with the bottom of the lower section and to unwind that part connected with the top. Before raising the tower the lower part is securely braced. The entire apparatus can be made of wood or metal.

This invention has been patented by Messrs. J. E. Sandberg and Magnus Akeson, of Butte City, Montana Ter.

EGG REGISTER AND TESTER.

The object of this invention is to provide a device by means of which the dealer may, at a glance, separate the bad from the good eggs; the device also automatically registers the number tested. In the engraving it is shown attached to an ordinary egg case. To use the tester, three eggs—that is, a quarter dozen—are placed in the holes in the pivoted top, which swings down to a horizontal position, thereby causing an arm



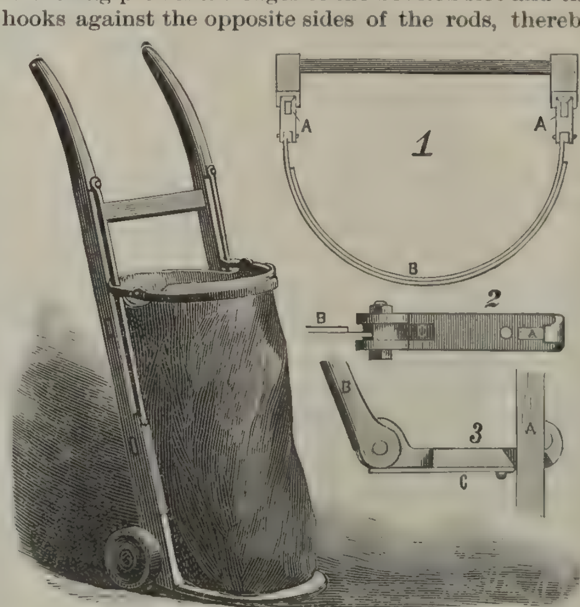
MARTI'S EGG REGISTER AND TESTER.

to move the large numbered wheel a distance of one tooth. The candle illuminates the eggs, the figures of which are reflected in an inclined mirror in the opposite end of the tester, and can be seen distinctly. The good and bad eggs can be readily distinguished. When the large wheel has made one revolution, the smaller one is moved one tooth. By means of the knob on the side, the register may be thrown out of gear.

This invention has been patented by Mr. Casper Marti, of 511 Washington Av. South, Minneapolis, Minn.

BAG HOLDER FOR TRUCKS.

This bag-holding attachment for trucks serves to hold the bag while it is being filled and transported. The side bars of the truck have recesses on their front edges, over which are secured rods, A. On each rod is a sliding clip, Fig. 2, formed with one forked and one hooked end. At the hook the clip has a slot, the ends of which are beveled, as shown in Fig. 3, and between the jaws of the forked end is pivoted a semicircular steel bow, B. When the holder is not in use, the clips are moved to the upper ends of the rod, and the bows folded up between the handles. When the holder is to be used, the clips are moved down, according to the length of the bag, and the bows are swung down to project from the front of the truck. The mouth of the bag is then clamped between the bows by raising one of them, passing a portion of the upper edge of the bag around the lower one, and then lowering the raised bow, when the bag will be firmly clamped. The weight of the bag presses the edges of the beveled slot and the hooks against the opposite sides of the rods, thereby



YOTHERS' BAG HOLDER FOR TRUCKS.

holding the clips and bows in place. Springs, C, bearing against the eyes formed in the ends of the bows hold them in any position; and shoulders formed on the ends of the bows, by striking the ends of the springs, prevent the bows from swinging down too far.

This invention has been patented by Messrs. Walter S. and Joseph W. Yothers, of Karthaus, Pa.; further particulars can be obtained from the former.

A COURSE in sanitary engineering has been created in the School of Mines, Columbia College. The course will occupy four years, and the graduating students will receive the degree of Sanitary Engineer.

SOME OLD WARWICK HOUSES.

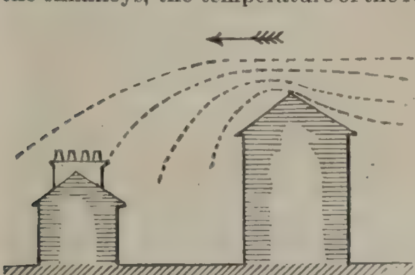
The two sketches which we produce from the pencil of Mr. Prince, of Manchester, afford a good idea of the Midland timber framed house, though they have not the ornate character of those within the walls of the old borough. The tree depicted in front of the old inn in Coton is one of the many trees in the neighborhood which is reported to mark the "center of England." The house in Mill Street, just under the Castle Tower, is larger and more pretentious. In its rear is a court-yard of considerable dimensions, and was of some importance when the highway from Brantmery to Warwick passed by it, when the old bridge was in existence a century ago. In its selected position it is little known, save to architects and artists, with whom it is a favorite subject.—*Build. and Eng. Times.*

SUGGESTIONS IN ARCHITECTURE.—OLD WARWICK HOUSES.

THE RELATION OF DOMESTIC CHIMNEYS TO THE CONSTRUCTION OF ROOFS.

There is no detail in house construction so perplexing as that of chimneys, especially with those addicted to so-called smoking, that is, to not passing the smoke in the way intended, but periodically admitting it into the apartments. By the same rule, there is no detail about which so little is known, or which is subject to so much neglect in house planning and building. There are few who will deny the assertion that faulty chimneys are the rule, and that perfect ones are the exception, or that their faults arise from a variety of causes.

In the present chapter we propose to deal with the relation of chimneys to the construction of roofs, and to leave the character of the grate, the construction of the chimneys, the temperature of the rooms, the supply of air, the situation of the flue in internal or external walls, and their size and form, for subsequent review. There is a common belief that in whatever position a chimney is situate, it is only necessary to carry it up to the height of the roof ridge; this is a popular error, and one that has intensified during the last century.



F I G. 1.

From the period of the old open fires of our ancestors, when the inmates breathed the wood or peat smoke, which mainly escaped from penthouses on the ridges of the roofs, there was a gradual advancement in the detail of chimney construction to the time of Queen Anne. The fire hearth had been moved from the center of the apartment to the wall, and the fire itself placed against a reredos, beneath a capacious chimney. These chimneys, in their infancy, were constructed of wood, lined or pargeted with clay, as may still be seen in our rural districts; or they were of brick, being independent constructions to the half timber buildings, as seen in Gainsborough Old Hall. At the Queen Anne period, when houses were built of brick, the chimneys, although amalgamated with the buildings, remained important features of construction, and as such were carried to a great height above the roofs.

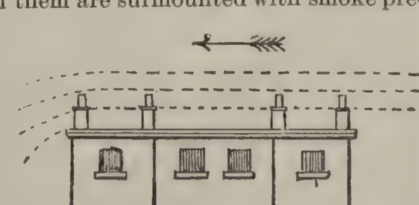
In some cases these Queen Anne chimneys were carried up with the gables, in others they rose from the level of the eaves; but in every instance their height was far superior to that of the ridge of the roof. From this date there was a gradual reduction in the capacity of the flues, a movement warranted by the introduction of grates, one which reduced the height and strength of the chimneys, and made them secondary features in house building.

It is to this custom, the one followed, with few exceptions, by the builders of to-day, that we wish to confine our remarks.

Perhaps there has been no former period in the history of house building in which smoky chimneys have been so common as they are at the present day. Certainly there has been no period when chimney doctors, patent coals, etc., were so numerous. This, in large measure, is owing to the use of gables and steep-pitched roofs, details credited to the so-called revival of Gothic architecture, a style which introduced long and artificial lines of ridges, which act as screens for the wind, and disturbing details in the working of chimneys. The steep pitch of such roofs disturbs the passing wind, at one time raising it over the ridge, and at another depressing it, and causing down-draughts in the adjoining flues. If the chimneys of a house are to work, a flat roof is of all kinds the best. The second best is a roof with a low pitch hipped at all points. The third best is a high pitched hipped roof, and the worst of all is a high pitched roof freely gabled.

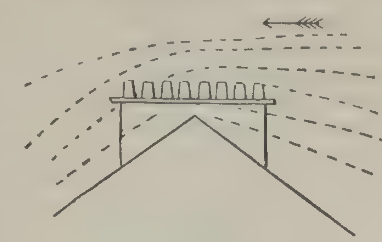
In the relation of domestic chimneys to the construction of roofs, it must be borne in mind that defects only present themselves in certain states or directions of the wind, and that, however a builder might try, he cannot succeed in constructing a chimney that will smoke under all circumstances. The wind in certain directions is favorable to the working of a defective chimney; in other cases it is opposed to it, and hence the construction of a chimney that will work under all states of the wind is a desideratum.

There are certain sites of houses in which it is impossible to construct chimneys which will satisfactorily work under all circumstances, such as that of a hill-side. In certain states of the wind it will come over the top, and pass down the hill, falling to the gradient of the land; in such cases, down draughts are created in the chimneys. In proof of this we can point to a steep pitched gabled house on a hillside, on the skirt of an important town; it is the highest house of all, and its chimneys are black over with smoke, and a great number of them are surmounted with smoke preventing cowls. The best sites are those on the summit of hills or on open level land, those in valleys being superior to those on hill-sides. All outward circumstances being in favor, we we will consider the various forms of chimneys in relation to the construction of roofs by the aid of diagrams. In doing so, we must assume there is no adjoining property overtopping the chimneys, as in Fig. 1, which shows a 40 foot street, with two story houses on one side and a tall mill upon the other. Here we see the wind passing over the tall building, damping down the chimneys of the houses, which, were it in an opposite direction, would create an up draught. Fig. 2 shows a flat roofed house, which has no influence upon the working of the chimneys.

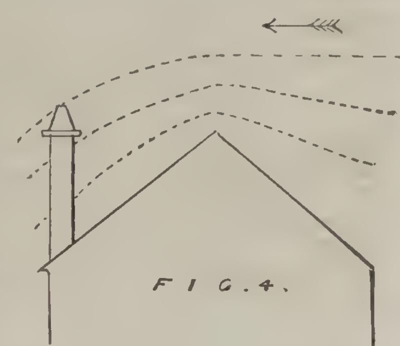


F I G. 2.

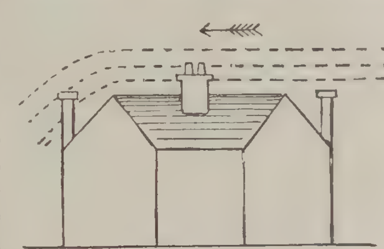
Fig. 3 shows an ordinary row of houses, with an ordinary pitched roof. The flues at the ridge will work under all circumstances (so far as their outward construction is concerned), while those placed at a distance from that point will smoke, as they are within the influence of the falling air; and hence it is customary to see the outside flues (if regularly used) raised or surmounted with cowls. Fig. 4 shows a very bad style of chimney, viz., that placed upon the eaves of a roof. If the roof is of flat pitch, and not very long on the span, such chimney may be relied upon to work if carried up a good height; but if the pitch is high or steep, and the span large, the evil is intensified; and such chimneys may be seen raised stage after stage, and surmounted with patent cowls, the whole stayed with iron bars to the roof, presenting appearances truly dangerous. Fig. 5 shows a familiar form of placing chimneys on the eaves of steep roofed houses. Fig. 6 shows the roof plan of a house where a steep pitch is indulged in. The chimneys A and B will not work when the wind is traveling from left to right, because a vacuum is created at that end of the building, which causes a strong down draught in the air passing the line of the ridge. The other chimneys, so long as they are the height of the ridge, will work under any circumstances. We have this case actually before us: A and B are the only chimneys which have been raised on the building, and these flues are fitted with smoke-preventing pots and cowls of various patterns. The B flues are much the worse, owing to a fall in the ground, the house being much the highest at this point. The chimney stacks are a dangerous height above the eaves, and are supported by iron stays. There are ladders on the roof, and reared against the chimney at B, as if permanently in use. With all this paraphernalia, the passer-by may see at a glance that these chimneys are not satisfactory in their working.



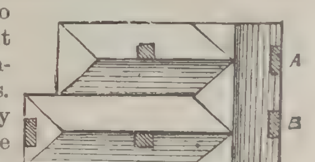
F I G. 3



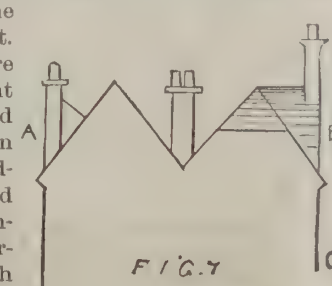
F I G. 4.



F I G 5

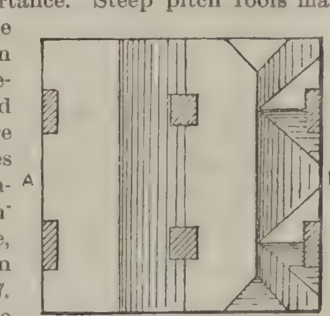


F I G 6



F I G. 7

In house planning, the disposition of the chimneys is a matter of great importance. Steep pitch roofs may be indulged in if the flues are carried up in the ridges. Gable-creating cross ridges should be avoided; but where necessary, two gables are advised. The chimney, when not convenient to be at the ridge, may be placed between the two, as in Fig. 7. Where it is imperative to place the flues on the eaves, as in A, Fig. 7, the roof should be gabled at the back to support the chimney, as at B, Fig. 7, by which a greater height may be safely indulged in, a further improvement being wrought by hipping the front gables. When the wind is coursing left to right, it falls on passing the ridge to fill the vacuum at c, and in avoiding this down draught the chimney must be carried a great height. The force of hipping the main gables and shortening the ridge is thus seen, as it tends to give the chimney an increased



F I G. 8

height in connection with the falling current of air. A very stupid arrangement is commonly carried out in middle class houses, of the kitchen being built out at the back, and the range being placed at right angles with the back wall, some two or three yards distant. The flues are here gathered over to the back wall, by which they are particularly horizontal at their junction with the main building, up which they are conveyed to a chimney at the eaves, as at Fig. 4. As is well known, such flues rarely work, and are most difficult to clean. A far better plan would be to place the range along the back wall of the main building, giving the full width to the narrow kitchen, and carrying the flue past the line of the eave to a height superior to the ridge, and protecting it with a gable, as at Fig. 7, B. Fig. 8 shows the roof plan of Fig. 7, where A is the ordinary faulty mode of construction, and B the improved mode of gables supporting the taller chimneys.

We have said sufficient to show that the subject of "The relation of domestic chimneys to the construction of roofs" is one worthy of great and careful consideration. That it has not had the attention it deserves is most true, proof of which is furnished every day. We can instance a large builder of fifty years' standing, who resided in a house in which the chimneys were constructed on the principle of Fig. 7, A. He dare not raise the brickwork of the chimney, and trust only to stays from the roof. The only course which appeared open to him was to fix pots and cowls designed for the prevention of smoky chimneys. This he did, indulging in about half a dozen varieties in three years; they all failed, and he had to leave, having built himself a house on adjoining land, on the same roof and chimney model.—*Building News.*

Tests of Stained Glass.

I have discovered a simple mode of testing whether, on the one hand, glass is sufficiently opaque so as not to appear flimsy or watery when put up in a window, unassisted by shading, according to the practice of the flat style of glass painting; on the other, whether it is sufficiently clear to produce as brilliant an effect as the old does. As follows: If the glass, when held at arm's length from the eye, and at the distance of more than a yard from an object, does not permit of that object being distinctly seen through it, the glass will be sufficiently opaque. And if when held at the same distance from the eye, and at the distance of not more than a yard from the object, permits of its being distinctly seen through the glass, it will be sufficiently clear and transparent.

I have found this to be the case with a great many pieces of glass of the twelfth, thirteenth, and fourteenth centuries, which had been rendered clear by polishing the surface, or which were already quite clear; for it is a great mistake to suppose that all old glass has been rendered dull on the surface by exposure to the atmosphere. I have seen a good deal of glass of the twelfth and thirteenth centuries that is as clear now as when it was first made, its surface not having been corroded in the least. But the glass of which these imitative works are made is either smooth on the surface and so pellucid or watery as, when held at arm's length, to permit of any object being perfectly seen through it which is at the distance of 100 or even 1,000 yards, or more; or else is artificially roughened on the surface, a practice which reduces the condition of the glass nearly to that of ground glass, for, when held at arm's length, it will not permit of any object being seen distinctly through it which is distant more than an inch from the glass.

The practice, not unfrequently resorted to by the imitators of old glass, of *antiquating* smooth surfaced glass—that is, dulling it with the enamel color used for painting the outlines—renders it, when held at arm's length, nearly if not quite as opaque as rough surfaced glass; indeed, almost the only perceptible difference in this respect between rough surfaced glass and smooth surfaced glass that has been antiquated is that the former is free from the tint necessarily imparted to the latter by the enamel color with which it is antiquated. Thus we find that imitations of glass of the twelfth, thirteenth, or fourteenth century, if executed in smooth surfaced glass that has not been antiquated, are very poor and watery in comparison with original work of the period; and that, if executed in glass that has been antiquated, or rough surfaced glass, they are much too opaque. In the one case, to speak popularly, the vision passes too uninterruptedly through the glass; in the other it is stopped at the surface of the glass, instead of passing about a yard through it, as in the case of ancient work.—*C. Winston, in The Architect.*

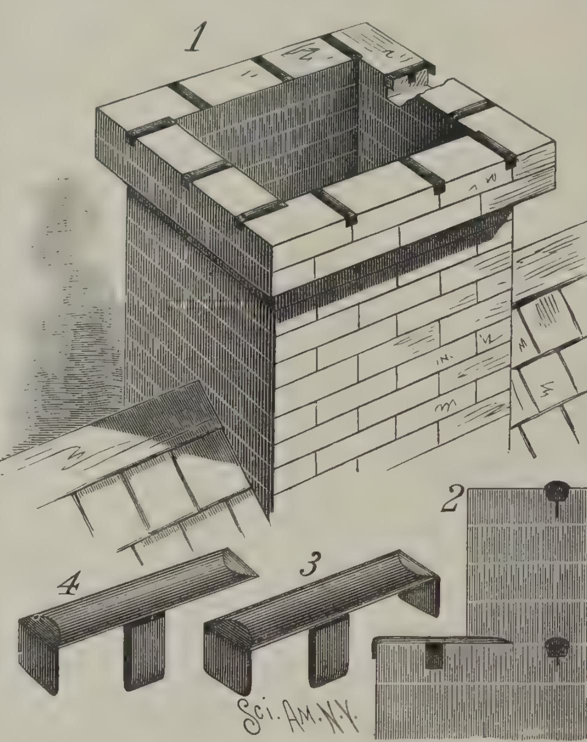
Westward the Squirrel.

Millions of squirrels are stated to be emigrating from Mississippi to the more elevated grounds in Arkansas. The plucky little animals swim the Mississippi River, beginning at a point about five miles below Memphis, and continuing from there twenty miles down stream. Thousands of them have been killed by the farmers, who use clubs in place of guns, on account of the immense numbers. A similar emigration occurred in 1872.

IMPROVED CHIMNEY CAP.

For durability in exposure to the weather, nothing seems better than the glazed surface of good, well burned brick. But in the upper courses of chimneys the end joints of the brick lack this quality of endurance; the mortar in these joints gives way, the loosening extends, and the whole chimney top falls to pieces. To protect these weak points and still utilize the brick surface in the chimney capping, is the object of the device shown in the accompanying engraving, and for which letters patent have been granted to Mr. J. W. Wetmore, of Erie, Pa.

One of the caps is about 4 inches in length, and crosses a joint from the outside to the inside of the chimney; it is held in place by a thin shank projecting from the under side down into the mortar between the ends of the brick. A flange extends from the outer end, as shown in Fig. 4, and a flange may also be made from the inner end, as represented in Fig. 3, down a short distance along the joint. The cap is convex on the upper and concave on the under side; but Fig. 2 shows a flat cap designed for covering a joint in an offset. In manufacturing chimney caps from stone and cast iron, the sizes must vary in order to adapt them to different chimneys. The advantage of this device is that the cap fits all chimneys built of brick of ordinary size. A builder who



WETMORE'S IMPROVED CHIMNEY CAP.

has used these caps, which are manufactured by the Chimney Cap Company, of Erie, Pa., says: "I examined them in the spring, and found them in good condition. The caps were perfectly firm in their places, the rain and gases and the freezing and thawing not having affected them in the least. There is nothing more to be desired for a complete chimney cap."

The Rotary Iron Jail.

The new jail just completed cost $30,000. Its peculiar feature is that the cells are arranged in the form of a great iron cylinder, which revolves about, so that only one cell is at the opening at any one time. This cylinder is three stories high, there being ten cells on each floor. Its weight is forty-five tons, and this ponderous weight is hung from above instead of turning on a track below. The strangest part of the arrangement is that the great cylinder can be turned by a simple crank with very little force—a man with his left hand moving it readily. When all is complete, it is the intention to have a little water motor in the basement, and then by simply moving a lever the cylinder will be set to rotating.

It is suggested that when there are prisoners who it is feared may be trying to cut out, the cylinder can by a motor be easily kept moving slowly all night, so that the prisoners do not remain long enough in one place to do any mischief, or even to crawl out if they had made a partial break. It seems that prisoners have little chance for escape from this new jail. A cage of iron bars completely surrounds the cylinder in which the cells are. The entrance on each floor is guarded by two doors. The officer standing outside does not have to unlock even the first door, but can swing the cylinder around until the cell appears in which is the desired prisoner, and then by a simple movement the inner door is opened, and the prisoner can step out of his cell. Then the officer can open the other door and let the man out, but the other prisoners are way beyond any possible reach of the officer, and it is impossible for them to make any break on him while he is taking a man out or putting one in. He can handle any number of men in the same way, and they cannot get within reach of him until he chooses to let them.—*Omaha Bee.*

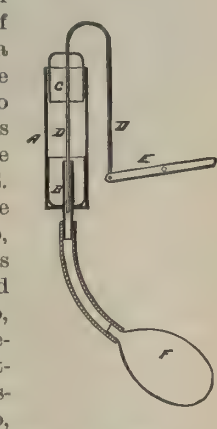
PHOTOGRAPHIC NOTES.

INTENSIFER FOR NEGATIVES.

It is recommended that a plate whitened with a weak solution of bichloride of mercury be washed, and immersed in a weak solution of pyrogallic acid and water. The density is greatly increased, and from three to four plates may be successively immersed in the single solution, after which a fresh solution of pyro should be made.

Simple Pneumatic Release for Shutters.—At a recent meeting of the Society of Amateur Photographers in this city, Mr. Grisdale presented a simple form of pneumatic release, constructed from a common combined patented metal pen and pencil holder. The handle or cylinder of the pen had a punched up coarse thread at each end, into which the shorter tubes holding the pen and pencil screwed, their threads being half an inch from their extreme rear ends. The handle was shortened and the screw thread was cut off, both on it and the pen tube holder; the latter was then inverted and fitted like a cap piston loosely into the handle. The accompanying illustration explains the construction more fully.

A is the handle with both screw threads cut off. B is the lead pencil cap inverted and soldered to tube, A. Through its center is seen a small metal guide tube, over the end of which is a rubber tube leading to a rubber bulb, F. C represents the penholder cap inverted, soldered to the guide wire, D, which passes through its center and also outside downward to the release trigger, E. The wire, D, also fits loosely in the lower guide tube. When the bulb, F, is compressed, the air passes through the guide tube around wire, D, and raises the piston cap, C, thereby elevating the wire, operating the release lever, E, and letting off the shutter. When pressure on the bulb is released, the cap, C, drops back. The cylinder, A, and cap, C, are nickel plated, making scarcely any friction to the movement of the cap.



The object of the lower guide tube is to prevent the cap, C, from binding against the sides of the cylinder. The release worked as perfectly as if it had been expensively made.

Orthochromatic Photographs.—No better proof of the failure of ordinary gelatine dry plates to accurately register the varying intensity of different colors is found than when one attempts to copy a brilliant oil painting or a chromo. Improvements in this direction are always interesting, and to Mr. Fred'k E. Ives, of Philadelphia, inventor of the Ives phototype process, belongs the credit of the development of chlorophyl as a sensitizing medium.

We were recently shown a few comparative specimens made by this process, which were remarkable for their softness and the brilliancy with which ordinary non-actinic colors, such as red and yellow, were brought out. Under each orthochromatic photograph was mounted an ordinary one. One of the drawbacks of the process is that the solution has to be freshly prepared shortly before use, and the exposure necessary is unusually long.

In explanation of the specimens shown us, Mr. Ives states that a wide angle rectilinear lens with the largest stop was used. The exposure was *five* minutes in direct sunlight. When the picture is particularly bright colored, only one or two minutes are necessary; but if, instead of a wide angle lens, a rapid rectilinear lens is used, it is possible, with a brilliant light, to reduce the exposure to less than a minute.

A curious fact observed was that the plates were relatively much less sensitive in a weak light than with bright sunlight, so much so as to require at least *twenty* times more exposure, while the proportion in an ordinary rapid gelatine plate would not be more than four or five times.

Speaking of the emulsion, he says: "The most sensitive plates are prepared with a fresh chlorophyl solution, which has been made up with alcohol tinted with eosine. But no eosine should be used in making up chlorophyl solutions which are to be kept more than a week, because an *old* chlorophyl solution gives more accurate photographs when it contains no eosine."

Regarding some of his recent experiments, he continues: "Lately I have had some emulsion which would not work clear except when the tea organifier was used with it. I would therefore advise any who experiments with the process to use the tea organifier, not only because it increases the sensitiveness to light, but because it may insure better results."

It is probable the line of experiments commenced by Mr. Ives may be followed up by some other interested experimentalist, who may discover a way of making color sensitive plates which will retain their sensitiveness, similar to the ordinary gelatine plate, for any length of time.

There is an ample field for improvement in this direction, and the subject is worthy the attention of all photographers and amateurs.

THE NEW CROTON AQUEDUCT.

For many years the present Croton Aqueduct—the line of which from Croton Dam to the Central Park reservoir is indicated by the heavy dotted line in the accompanying map—has been forced to carry a quantity of water much greater than its builders designed it for, and as a natural consequence it has been so weakened that nothing but the skill and incessant watchfulness exercised by those in charge have prevented it from long ago yielding to the burden thrust upon it. The necessity for quickly providing greater carrying capacity is, therefore, apparent.

It is estimated that, even in years of the greatest drought, the Croton watershed, from whence almost all of the present supply is obtained, can be relied upon to furnish 250,000,000 gallons daily, or 100 gallons per head per day for 2,500,000 people. The building of Quaker Bridge Dam* would increase the available area of watershed to 361·82 square miles, and the reservoir thus formed would have a capacity of 32,200,000,000 gallons—water sufficient to cover 9,400 acres, 10 feet deep. The dam will be built of solid masonry, will be 178 feet high above the bed of the river, and since the foundation will have to extend to bed rock—100 feet—the total height for a distance of about 400 feet in the lowest part of the valley will be about 300 feet; the width of the dam at the base will be about 200 feet, and the extreme length 1,300 feet.

The aqueduct now being built has a maximum flowing capacity of 320,000,000 gallons per day from Croton Dam to a point near the New York city boundary line, where it is designed to construct a large distributing reservoir to supply the annexed district; a part of the supply being there diverted, the remaining portion of the aqueduct has a flowing capacity of 250,000,000 gallons per day. The northern portion, shown in section in Fig. 4, is 13·6 feet high and 13·6 feet wide; the semicircular arch has a radius of 6·8 feet, the concave sides are on a radius of 20·92 feet, and the invert has a radius of 18·5 feet. Where necessary, the rock walls are evened with concrete, and a masonry lining built 12 inches thick at the sides and arch and 6 inches thick at the invert; but where the character of the rock justifies it, no masonry is needed. The other part of the aqueduct, about 6½ miles in length, will be circular in section, as shown in Fig. 3, 12 feet in diameter, and lined with masonry 12 inches thick. Owing to the insufficient elevation of the land, this section will be depressed about 100 feet below the other, as indicated on the profile. The Harlem River is to be crossed by an inverted siphon, the depth below the river being about 200 feet. All the masonry will be of hand made, hard burned brick, laid in cement mortar, one part cement to two parts clean sharp sand.

From Croton Dam to Harlem River the aqueduct is 28¼ miles long, and to Central Park reservoir 33¼ miles; the total length of open cuts—varying from 0 to 40 or 50 feet between the arch and ground surface—north of the Harlem is but about 3,000 feet; all the rest of the line is through solid rock. The method of building the aqueduct is by sinking shafts about one mile and a quarter apart, and working both ways from each. There are 24 shafts north of the Harlem and 8 south of it, varying in depth from 28 to 350 feet. Fig. 1 of the engravings is a longitudinal section through shaft No. 10, showing the heading, the timbering in the shaft, and the location of the hoisting machinery. Fig. 6 is an enlarged view of the same heading. Fig. 8 shows the boilers, air compressors, and hoisting engines. The shaft is 17½ feet by 8 feet in the clear, with the longer dimension parallel with the axis of the tunnel. In the shaft run two cages, operated by a double drum Dickson hoisting engine, on one of which the loaded car is brought to the surface, while on the other an empty car is lowered into the tunnel. Steam for hoisting, pumping, and compressing air is furnished by two 90 horse power Ingersoll return tubular boilers. The Ingersoll "Straight Line" air compressors and "Eclipse" drills are here used; and so well thought of are the products of the Ingersoll Company, that on the line of the aqueduct there are now in use 200 drills, 18 compressors, and 30 boilers of their make. The air compressors at shaft 10 have 18 by 30 inch cylinders, supplying air at 80 pounds pressure per square inch, the air being first discharged into a condensing air receiver, where it is freed from all moisture, and then conducted down the shaft and into the headings through 3 and 3½ inch pipe. Each heading is driven by four 3½ inch drills, mounted two on one column, to which they are attached by means of swinging arms, which can be moved up and down or around the column; thus with two columns and four machines, the entire face is commanded at one setting of the columns. From 19 to 20 holes, 5 to 6 feet deep, are drilled for the center cut and squaring up. Two drills, mounted on tripod, drill from three to five holes 8 feet deep in the bench, some being vertical and others flat or lifting. The holes are then charged with No. 1 giant powder in the cut and No. 2 in the side and bench, and exploded by electricity.

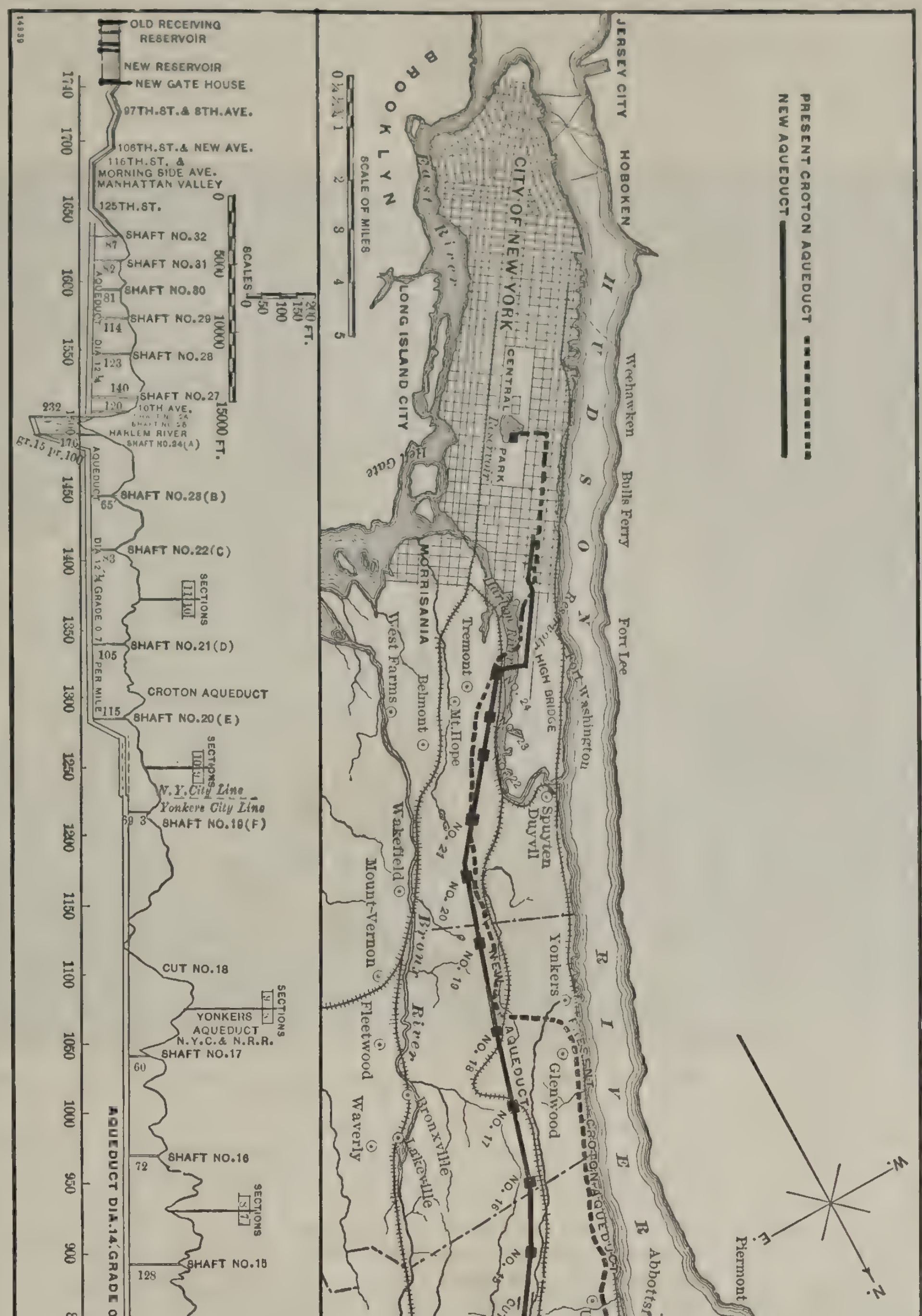
The foremen are required to have a round of holes drilled and blasted once each shift of ten hours, it being left to their judgment to decide the depth of cut they shall undertake to drill, square up, and blast in that time. By this method an average of about 10 lineal feet of tunnel is completed every twenty-four hours in each face through very hard gneiss and granite. This is a higher rate of progress than is attainable by the deep cut system, which does not permit of each shift finishing its own work.

Extending down the shaft is a rough looking square wooden box, which branches at the bottom, one part extending along the tunnel to one heading, and the other part to the other heading. At the bottom of the vertical portion, exhaust steam is admitted; this produces a strong current along the branches and up the shaft. The smoke resulting from each blast is thus drawn into the boxes and delivered at the top of the shaft.

Where the aqueduct is under pressure, special provision is made in the manholes for guarding against the upward pressure, and drain pipes are provided for emptying the shaft and air pipes for the escape of air during the refilling of the tunnel. A general idea of the construction of one of these shafts may be obtained from Fig. 7, which is a section at right angles to the line of the aqueduct.

Fig. 2 is a view of the work as it now appears at the Pocantico cut—the most extensive on the line, as it has a length of about 1,800 feet. The aqueduct here is similar in sec-

MAP AND PROFILE OF THE NEW AQUEDUCT FOR INCREASING THE WATER SUPPLY OF NEW YORK CITY.



* The proposed dam at Quaker Bridge was illustrated and described in the SCIENTIFIC AMERICAN of May 3, 1884.

tion to one in rock, as may be seen by comparing Figs. 4 and 5. It has a clear height of 13·53 feet and an extreme width of 13·6 feet. The arch is 12 inches thick at the crown, 16 inches thick at the center of the sides, and 20 inches thick at the spring lines. The concave sides are 8 inches thick and are secured by walls, as shown in the cut. The invert is 12 inches thick, and rests upon a concrete foundation.

At 135th Street a gate house will be located. Contracts have been let for all the work, with the exception of this gate house and the inverted siphon under the Harlem. The Quaker Bridge project has not yet been definitely settled upon. The contracts have been awarded as follows: Sections A and B to Mr. Herman Clark for $2,147,740; sections 9, 8, 7, and 6 to Messrs. O'Brien & Clark for $4,445,447; sections 5, 4, 3, and 2 to Messrs. Brown, Howard & Co. for $5,297,155; and the gate house at Croton Dam to Messrs. Smith & Brown for $442,000. On the 24th of October the total length of tunnel completed was 22,342 feet, and at the present time the excavation is growing at the rate of one mile per month.

The engineer corps is composed of the following named gentlemen: Mr. Benj. S. Church, chief engineer; Mr. A. Fteley, deputy chief engineer; Mr. H. S. Craven, constructing engineer; Messrs. Chas. S. Gowen, J. B. McIntyre, J. W. Wolbrecht, Alfred Craven, E. S. Gould, F. W. Watkins, and E. Wegmann, Jr., division engineers; Mr. F. S. Cook is in charge of the draughting bureau.

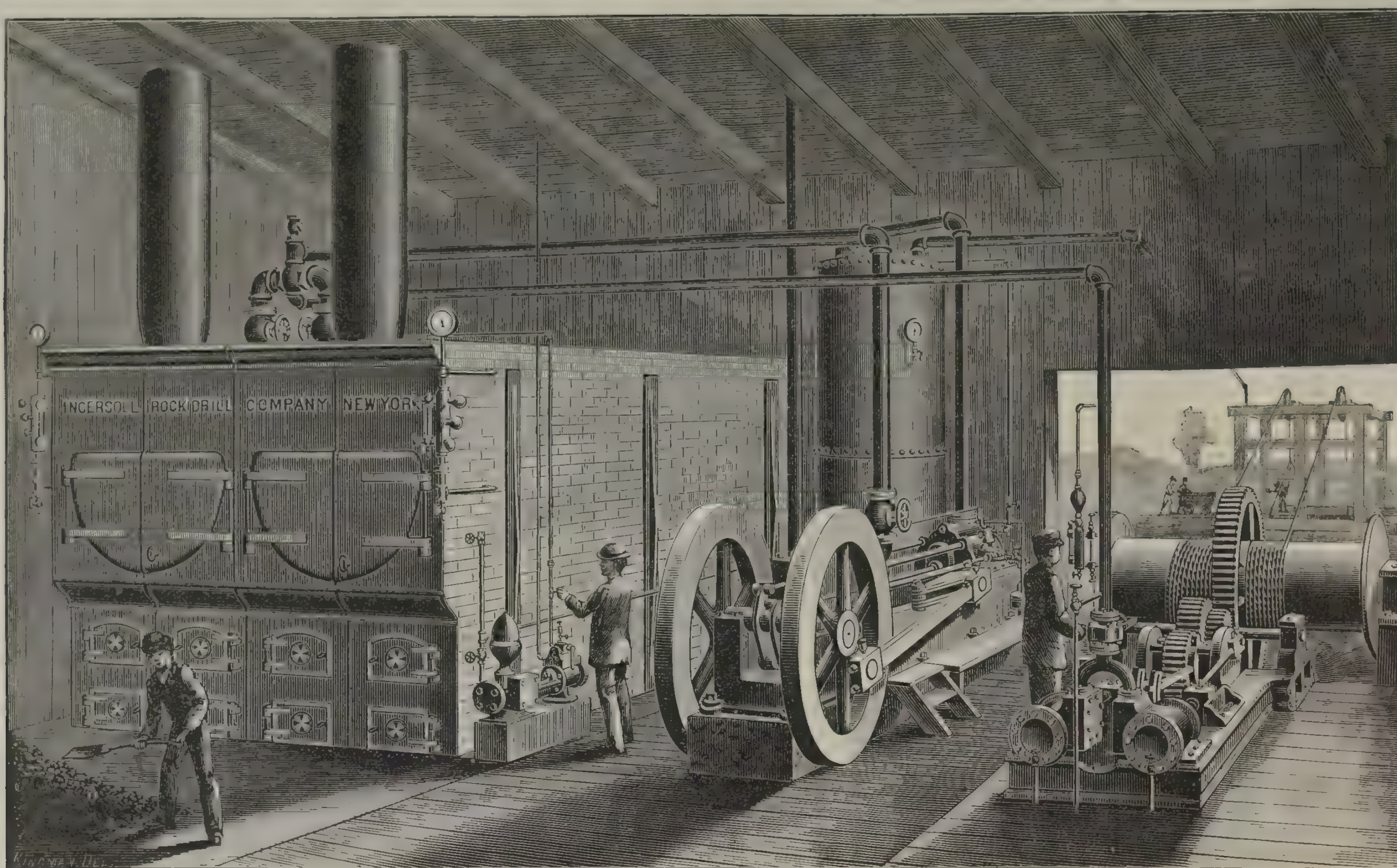


Fig. 8.—VIEW OF THE PLANT AT SHAFT No. 10, ON THE LINE OF THE NEW AQUEDUCT.

Improved Tent.

New felt tents were recently introduced in the Danish army. They are composed of rectangular wooden frames, on which felt is tightly stretched. Being of rectangular form with vertical sides, these tents occupy comparatively small space; they are very stable, need not be fastened with ropes to the stakes as is the case with canvas tents, and their erection requires but a few minutes. Felt being a bad conductor, these tents afford a good shelter from cold and heat, and withstand action of moisture better than canvas tents.

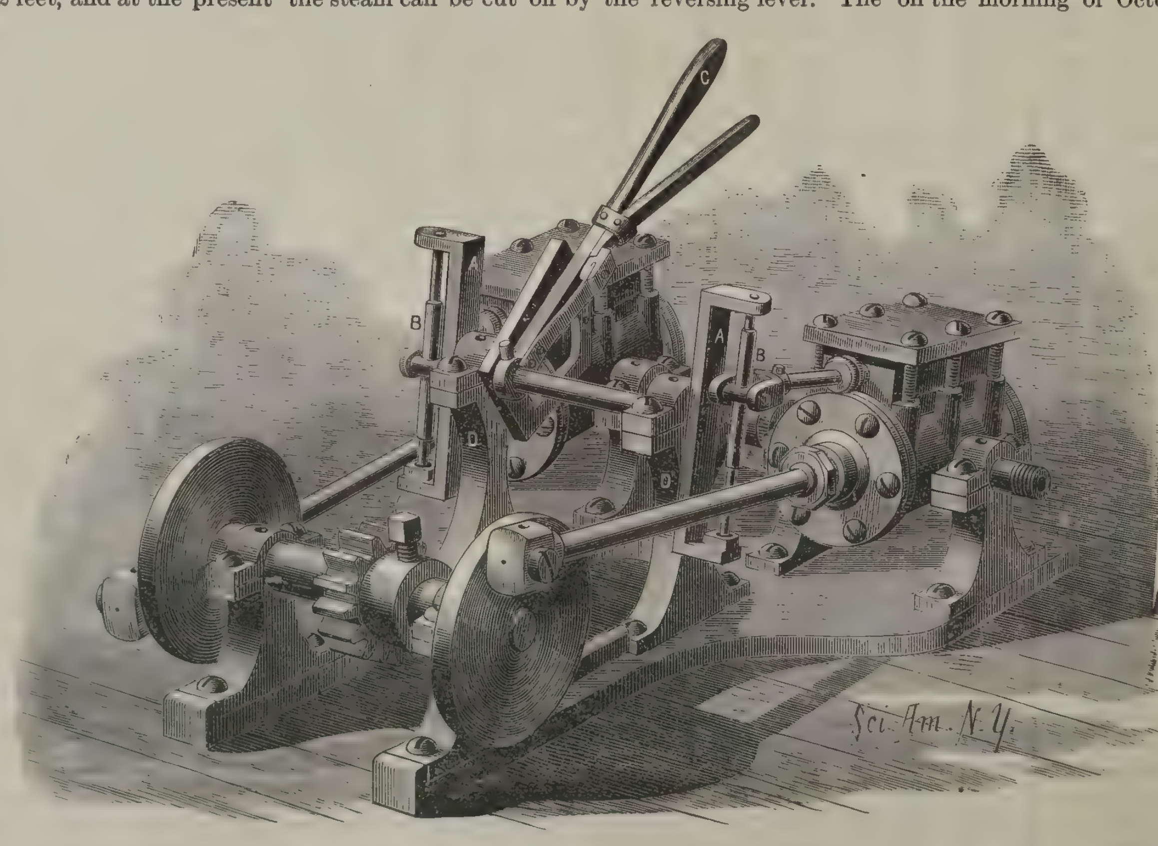
TITIAN R. PEALE, of Philadelphia, died on the 13th of March, 1885, in his 86th year. Mr. Peale was one of the naturalists of the Wilkes Exploring Expedition. He was for twenty-four years connected with the Patent Office at Washington.

A NEW LINK MOVEMENT FOR REVERSIBLE ENGINES.

In the reversible engine shown in our engraving, the cylinder is of the usual slide valve order, and operates the valves by its oscillation on the supporting trunnions. The inner trunnions form the inlet pipes, and the outer the exhausts. The slide valve rod is flexibly connected with the sleeve, B, which slides up and down on the rod of the link, A. This flexible connection permits the sleeve to adjust itself to any inclination of the link.

To the ends of a transverse axle supported in the standards, D, the links are rigidly attached, and are thus capable of a backward or forward motion, their position being determined by that of the reversing lever, C, also rigidly attached to the transverse axle. A direct or reverse motion is given to the piston by altering the inclination of the links, and consequently, through the sleeves, of the slide valve rods. Like all other reversing engines, there is a dead center, so that the steam can be cut off by the reversing lever. The action of the links hastens the opening and closing of the ports, and the steam therefore works more expansively than when the ports are operated by an eccentric. This link movement effects a great saving of friction by dispensing with all eccentrics, crossheads, crosshead slides, eccentric yokes, rods, etc., while the first cost of the engine is fully one-third less than that of the ordinary type. The absence of these parts makes the engine compact, and reduces the necessary weight of the bed plate. It is an engine particularly adapted for hoisting, propeller, or traction work; and besides the great advantage of the simplicity of its parts, makes less noise, even when much worn, than the ordinary link movement when new. The motion of the valve being derived from the sliding of the sleeve up and down on the inclined rod of the link, there is no sudden stop, and consequently no hammering. We have shown the movement applied to a double cylinder hoisting engine, but it will also operate with a single cylinder for stationary work.

Any further information concerning this invention may be obtained from Mr. T. J. Baum, 79–81 Race St., Cincinnati, Ohio.



BAUM'S NEW LINK MOVEMENT FOR REVERSIBLE ENGINES.

General George B. McClellan.

Speedily following the death of Gen. Grant has come that of another of the great generals of the Union Army during the late war, Gen. George B. McClellan, who died very suddenly, from neuralgia of the heart, on the morning of October 29, at his home on Orange Mountain, N. J. He was not quite 59 years of age, and his condition was apparently so robust that all who knew him thought there were yet many years of an honored and useful life before him; but his death occurred in about three hours from the fatal attack, after a day of but ordinary business activity. Since the war, besides having served a term as Governor of the State of New Jersey, Gen. McClellan has filled various important positions, in which his abilities as an engineer and a man of broad executive capacity have been conspicuous. Personally, he was loved and honored by all who knew him.

Agee's Improved Corn Planter.

In the SCIENTIFIC AMERICAN of October 24, 1885, we described and illustrated an improved corn planter possessing many excellent features. It is simple in construction and reliable in operation. The present address of the inventor, Mr. George S. Agee, is West Plains, Howell County, Mo.

FRENCH paper makers are highly elated at the Government's resolve to abolish the tax on papers, which has been in force since September, 1871. Though not coming into operation until December 1, 1886, they are still satisfied, as the battle they have been fighting has been a terribly uphill one.

THE NORDENFELT SUBMARINE BOAT.

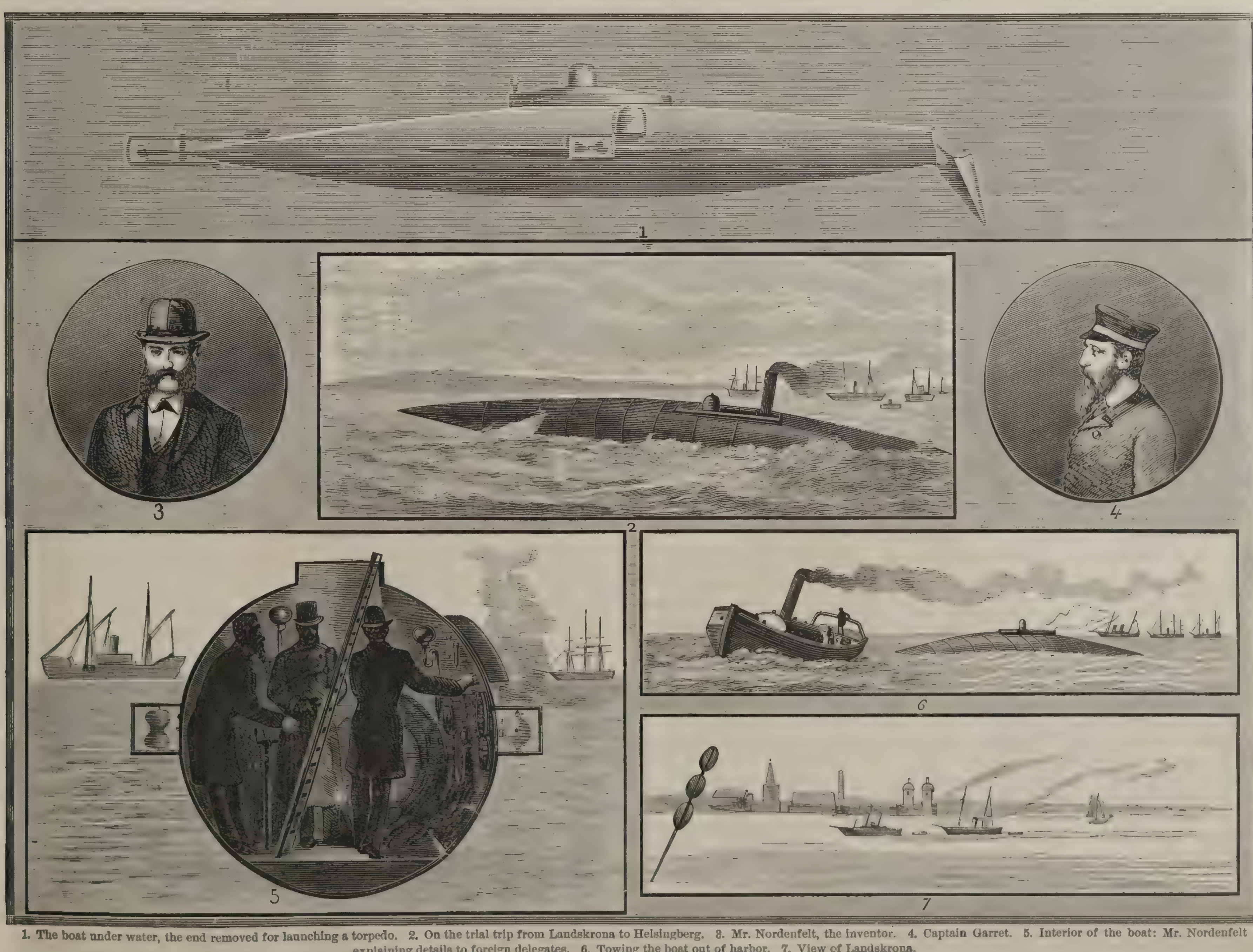
In September last, just before leaving Denmark for the south, the Prince of Wales, with the King and Queen of Denmark and the Czarina, witnessed off Landskrona, a town on the Swedish coast, an interesting and successful trial of the new submarine boat which has been built at Stockholm upon the plans of Mr. Nordenfelt, the inventor of the machine gun so extensively used in modern warfare. Ever since the American civil war, naval engineers have been striving to solve the problem of submarine navigation, but until now with very little success. Mr. Nordenfelt's invention, however, appears to fulfill the numerous requirements for overcoming the difficulties and dangers of maintaining, driving, and directing a boat beneath the water.

THE NORDENFELT SUBMARINE BOAT.

The boat is built of steel, and is cigar-shaped, with a glass conning tower in the center, from which the commander can keep a lookout. This dome is protected by a strong iron cover. There are three engines, one to work the screw in the stern, which propels the vessel, and two to work the propellers on either side, which, when set in motion, compel the boat to sink, and maintain her at a certain depth beneath the surface. When it is wished to sink the boat, enough sea water is taken in to reduce the buoyancy to 1 cwt., and this suffices to keep the tower just above the surface. The side propellers then being set in motion, the vessel can be sunk to a required depth, there being an automatic arrangement by which the engines are stopped directly that depth is exceeded. An automatic horizontal steering gear also prevents the boat from going down or up head foremost, an even keel being preserved throughout all the maneuvers. Should a breakdown of the engine occur, the boat from its own buoyancy at once rises to the surface.

The motive power is steam, and as long as the vessel is above water the fires can be stoked, the smoke being driven through two channels, which pass partly round the hull and point aft. When, however, the boat sinks, the fires have to be sealed, and reserve steam is used, which is kept at high pressure in two tanks. With this the boat has been driven for five hours at a speed of three miles an hour. Her speed on the surface is eight knots. The crew number three, and during their submarine existence have to subsist on the amount of air which they take with them in the hull, in which four men have subsisted for six hours without any especial inconvenience. The boat is 64 feet long, and the central diameter is 9 feet. The enormous utility of such a vessel as this in naval warfare is at once apparent. Moving without the slightest apparent sign of existence, she can launch torpedoes against hostile vessels, enter a harbor unperceived, and render useless the most complicated system of submarine mines. The trial at Landskrona was witnessed by officers representing every European power. Admiral Arthur and Major-General Sir Andrew Clarke were among those representing the English services.

We are indebted to the *Illustrated London News* and London *Graphic* for our sketches.



1. The boat under water, the end removed for launching a torpedo. 2. On the trial trip from Landskrona to Helsingberg. 3. Mr. Nordenfelt, the inventor. 4. Captain Garret. 5. Interior of the boat: Mr. Nordenfelt explaining details to foreign delegates. 6. Towing the boat out of harbor. 7. View of Landskrona.

THE RECENT EXPERIMENTS WITH THE NORDENFELT SUBMARINE BOAT AT LANDSKRONA, DENMARK.

Correspondence.

Origin of "Atlantic."

To the Editor of the Scientific American:

The correction made in your edition of the 17th of the present month, by G. W. R., of the etymology of the word *Atlantic*, from the Nahuatl *Atl*, water, *tlan*, near, between, we gladly would receive, were it not that it contains *tiny wee* flaws which greatly want repairs, although of no consequence to the kind corrector.

He informs his reader that the word *Atlantic* is derived from the Greek *Atlantikos pelagos*, which means *the open sea Atlantic*, though he has rendered it *beyond Mt. Atlas;* but he has forgotten to tell him also wherefrom the Greeks have obtained the word *Atlantikos*, hence its origin, and he has likewise failed to explain the etymology of the name of the patient old god *Atlas*, who is said to have sustained so long the whole world on his shoulders.

Truly, we would like him to give us the origin of these names; for to explain one by the other would seem like beating the devil round the stump a little too much.

AUGUSTUS LE PLONGEON, M.D.

204 Washington St., Brooklyn, Oct. 22, 1885.

The Star in Andromeda.

To the Editor of the Scientific American:

There does not seem to be the slightest evidence that the bright star which appeared in 1572 in the constellation of Cassiopeia had ever been authentically observed before. Most astronomies mention that a star appeared in the same position in the heavens in 945 and 1261, but have not been able to prove that it was identical with the Pilgrim.

The present attempt to identify the star recently discovered in the nebula of Andromeda with this Pilgrim star of Cassiopea seems very fanciful when one reflects for a moment what an incalculable distance separates the two positions, and what an incredible velocity would be required of this wandering star to traverse the space in the brief period of 313 years.

GEO. R. CATHER.

Ashville, Ala., Oct. 19, 1885.

At the Interior.

PORPHYRY DYKE.

Chemistry is still a new science; it was only in 1776 that Priestley discovered oxygen, and until then the science can scarcely be said to have existed; for without a knowledge of this essential element, all systems and methods were purely empirical. But in this little more than a century many wonderful results have been accomplished, and the new science ranks quite as high in its progressiveness as those of more ancient origin. Working with its sister sciences of physics and geology, the life history of our planet is being gradually unfolded by its aid; the cataclysms which the older philosophers were contented to offer as explanations of all past operations of nature are now fading altogether from sight, and giving place to a belief in the continuity of natural forces. Men are no longer content with these vivid pictures of the imagination, and ask, instead, the sober deductions from observed facts. The forces which have been observed in operation during the historical period are found to be all sufficient to explain the present condition of the earth.

This tendency toward the rational method has nowhere been better illustrated than in our study of the interior of the globe, and of the reactions which occur in this subterranean laboratory. No uniformity of belief has been attained, it is true, but the questions have been handled more scientifically. The origin of coal is a case in point. The early geologists pictured the carboniferous swamps, where the vast stores of fuel were accumulated, as covered with great forests of lepidodendrons, sigillaria, calamites, and gigantic tree ferns, and enveloped in an atmosphere so saturated with carbonic acid gas that only the lowest forms of animal life were possible. The ideal foliage of the coal period is a diagram familiar to most students, and it is certainly very striking. Now, however, patient investigators with the microscope, and in the field, point out to us the structure of mosses and lichens in the apparently structureless coal, mere weeds by the side of the pictured giants, and show us the undeniable similarity between the ancient swamps of the carboniferous and our present peat beds. The excess of carbonic acid gas in the atmosphere, which formed so pleasant and convenient an hypothesis, has been so far reduced that there is even a doubt whether the amount was any greater than at present. The position of the coal beds is no longer ascribed to the sudden sinking of the carboniferous formations and the rapid accumulations of the superimposed strata.

The gradual settling of the bed of the Pacific and of portions of the coast of Northern Europe offer a sufficient explanation for the change of level which in time submerged the coal swamps and permitted the deposition of the Mesozoic and Tertiary rocks, which in turn produced by their weight the pressure and heat necessary for the consolidation of the peat into coal. The origin of rock oil, or petroleum, has led to even greater discussion than the question of coal; for beyond the observation that it comes from the rocks immediately underlying the coal formation, the Devonian system, few facts regarding it are known, and the fancies of the theorist have therefore a fertile field for their generation. There are so many possibilities that there is an unusual chance for originality. It is generally conceded that the oil has not originated *in situ*, but has come either from above or below, from the distillation of the volatile constituents of the coal deposits, which have descended and become condensed in the Devonian sands, or from the destruction of vast beds of seaweed or other organic matter in the Silurian below. The idea that the amount of petroleum is too great to have originated from either vegetable or animal deposits has given rise to still another theory, which supposes that the oil originates from chemical combinations of hydrogen and carbon in the interior of the earth.

Our knowledge of the conditions which maintain in this interior laboratory is still too slight to warrant any definite assertion in regard to the possibility of such a reaction occurring on the large scale; but we do know that in our surface laboratories the hydrocarbons in this series are derived from the decomposition of more complicated hydrocarbons, and not from a direct synthesis of the component elements. Baron von Richthofen's explorations in China have disclosed a single anthracite coal field in one of the provinces of that empire which contains sufficient material to supply the coal demand of the entire world at the present rate of consumption for over 2,000 years. These evidences, and those derived from the vast beds of limestone found the world over, whose organic origin is not questioned, do not lend support to any argument which disputes the organic source of petroleum on the supposition that such an origin would tax the life resources of the planet.

When any object becomes prominent, it is very natural for us to want to know where it came from, and its history. If it be a man who attracts our attention, we want to know his record, and later of his ancestry. The biography of an invention which attains a wide application becomes of great interest to us. The crude materials of large industries or the staples of everyday life have a place in history. Products of such importance as coal, petroleum, and natural gas excite a curiosity aside from either scientific or economic considerations, and to learn their history means the comprehension of many modifying conditions. Our investigations in this direction are still very elementary, for the simple question of temperature and the varying effects of pressure in modifying its action are still under discussion. The latest effort to obtain some definite information on this point, that of the German Government in sinking the deep shaft near Schladebach, which has gone down nearly 5,000 feet, has really told us but little. The deductions drawn from this very slight puncture are that at a depth of about two miles the temperature of boiling water would probably be reached, and at forty-five miles the heat of melting platinum would prevail—that is, the temperatures at which water boils and platinum melts at the surface; but when the effect of pressure is considered, we are uncertain that the temperature of boiling water is ever reached. In the radial race between the actual boiling point and the increased temperature of that point due to pressure, it is impossible to say that the one ever catches up with the other. When we are unable to decide so simple a point as whether water can ever reach the boiling point in the interior of the earth, the more complicated processes of chemical decomposition and reformation seem quite beyond our grasp; but a fuller knowledge of the chemical and physical laws which maintain under ordinary atmospheric pressure and temperature will go far toward the explanation of those hidden processes which take place beneath the surface. It is an encouraging sign in our scientific progress that we are coming to consult evidence rather than exercising our energy in the formulation of ingenious theories to take its place.

A Paper Chimney.

A manufacturer of Breslau is stated to have built a chimney, over 50 feet in height, entirely of paper. The blocks used in its construction, instead of being of brick or stone, were made of compressed paper, jointed with silicious cement. The chimney is said to be very elastic, and also fireproof. We may add that picture frames are now made of paper on the Continent. Paper pulp, glue, linseed oil, and carbonate of lime or whiting are mixed together and heated into a thick cream, which, on being allowed to cool, is run into moulds and hardened. The frames are then gilt or bronzed in the usual way.

IN Memphis, Tenn., sixty buildings have been condemned by the authorities as unsafe for habitation. Owners are required to put them into habitable condition or to demolish them. Most of them will be torn down and new dwellings erected.

Liquid Fuel in California.

A few months since, we gave an account of the experiments which were being made by the Central Pacific Railroad Company with petroleum as fuel on some of their steamboats. At that time they had tried it upon the freight steamer Thoroughfare, plying between Oakland and San Francisco, and on the transfer boat Solano—the largest ferryboat in the world—on Carquinez Straits, running between Benicia and Port Costa.

Since that time they have been able to determine more in detail concerning the results. On the Thoroughfare they saved $7,000 in the cost of fuel in the five months they were using oil as compared with the five months of the same season last year, when they were burning coal. Besides saving 44 per cent in actual fuel, they got rid of four firemen, which makes an additional saving of $240 per month. On the Solano there is not so much saving, the cost being lessened but 17 per cent. She makes short trips, and they burn the fuel while she is in the slip, to generate necessary steam.

The oil costs $1.70 per forty gallon barrel, or about four cents a gallon. It is estimated by the engineer of the big Water Witch, which is also using oil, though a somewhat different kind from that used by the railroad company, that 100 gallons of oil is equal to a ton of coal, which latter costs about $7 per ton.

The Oakland ferryboat Piedmont has just been altered so as to use the liquid fuel. She has not yet been put at work under the new system, but will be in a few days. The oil is sprayed under the boiler by a steam jet, and is supplied by suitable tanks. A supply tank is kept on the wharf, so that the oil may be led into the steamer's tanks. The supply tank is filled from tank cars, so there is no handling. There is no smoke or soot, and of course no ashes. It is stated that in addition to the lower cost of the liquid fuel, the services of 16 firemen will be dispensed with on the Piedmont. The mechanical alterations to effect the change of system are slight. The other ferryboats will be changed to burn oil shortly.

As the coal used on these steamers was imported, and a good deal of California petroleum will probably be used, the change will be good for this State in utilizing one of its products. The amount of petroleum obtained from California has steadily been increasing for the past five years. In 1879, 19,858 barrels were produced, and in 1884 more than 100,000 barrels, thus quadrupling the yield in the space of five years. California now ranks third among the petroleum producing States; New York is second, and West Virginia fourth. The petroleum resources of the State are being carefully developed, and the more of the product we can use here, the better it will be for California.—*Min. and Scien. Press.*

Slag Wool.

Slag wool is a substance produced by the action of powerful jets of steam upon the melted slag from the furnace. It is in fact a species of glass blown out by steam into the form of fine threads. It is incombustible, and in England it is much used in buildings as a filling. In Mansard roofs the space between the exterior covering and the interior lath or paneling is filled with this material. The heat of summer in upper apartments is thus very much mitigated. Used around water pipes and the like, it prevents their freezing in winter. It is an excellent protection when used as a covering for steam boilers and furnaces. It is a nonconductor of heat, and thus it is well adapted for use in lining the air spaces of refrigerators.

Paper in Tonkin.

The principal material used in the manufacture of paper in Tonkin is the *ke-yioh* or paper tree, which grows in abundance on the mountains in the environs of Sontay. The dried bark of this is brought in bundles upon the backs of oxen or buffaloes from the mountains, where it is gathered for the numerous paper mills, whose principal center is in the vicinity of Hanoi. It is worth about two cents a pound. This bark is macerated and then rubbed up in mortars, so as to reduce it to a fine pulp. This latter is extended with a certain quantity of water in order to form a clear paste, which is sized with an infusion made from the shavings of the *gomao*, a tree which grows in abundance on the Black River mountains.

The paper is manufactured sheet by sheet by women by means of delicate bamboo screens that they alternately dip into the paste and take out therewith a thin sheet of paper, which they deposit upon a board. At the end of the day these sheets are put into a press in order to extract the moisture from them, and are then dried by placing them one by one upon a hot masonry wall. Finally they are put up in packages and trimmed.

Each woman makes a thousand sheets a day. The thickness of the paper depends upon the consistency of the paste. One establishment that was visited by the person who furnished these data was capable of producing 80,000 sheets per day with 80 women and 40 assistants. Paper was being made here worth 65 cents per thousand sheets.—*Gutenberg Journal.*

ENGINEERING INVENTIONS.

A governor for supplying gaseous fuel has been patented by Mr. Alpheus Darling, of Petrolia, Pa. This invention covers certain novel features of the governor and its connections to the gas well and boiler, to make the governor more sensitive to variations of boiler pressure, and to more efficiently control the fuel supply.

A surface condenser has been patented by Mr. Benjamin S. Benson, of Baltimore, Md. By this invention the steam is passed through a set of cells in one direction, and condensed by a current of cold air blown forcibly through an alternate set of cells separated only by thin metal partitions, the device being adapted for traction engines or locomotives where water is scarce.

AGRICULTURAL INVENTIONS.

A harrow has been patented by Mr. Franklin McCoy Jansen, of Sheldon, Iowa. It consists of a series of frames with toothed sockets, so arranged that the teeth may be used straight or slanting, so the harrow may be used on rough or smooth ground, or can be made to present more or less harrowing surface, as desired.

A weed pulling machine has been patented by Mr. Edward L. Rasmusson, of Duluth, Minn. It consists of two sets of revolving wheels, with an endless chain and spurs, made to work in a recessed frame, and a device for imparting rotary motion to the chain wheels from the main axle, with an adjustable swinging frame and dragging wheel, to pull out weeds by the roots.

A hay raker and loader has been patented by Mr. Joseph I. Davis, of Mt. Hamill, Ohio. The construction is such that the machine may be drawn behind a wagon, when the hay gathered by a rake is lifted by the teeth of a reel and carried up on an elevator and carrier to be delivered into the wagon, saving time and obviating the necessity of stacking in the field.

MISCELLANEOUS INVENTIONS.

A sewing machine has been patented by Mr. Otto L. Schastey, of New York city. It is a single thread machine, and has a vertically and laterally reciprocating needle bar, to make a cross or binding stitch, especially applicable for sewing edges of material.

A wagon jack and step ladder combined has been patented by Mr. Frank N. McKean, of Long Branch, N.J. It consists of a frame so made with bars to serve as steps as to be readily adjustable for either use, and to be convenient and reliable with either adjustment.

An adjustable chair has been patented by Mr. Hamlet S. Felton, of Chester, Ill. It is made to be folded together very compactly and lowered through an opening in the floor, whereby a room, hall, or theater, with such devices, can be cleared to afford an open floor in a few minutes.

A hat or bonnet support has been patented by Margret Smith, of Baltimore, Md. The device may consist of a bandeau or comb, having elastic pins so secured that when free they will assume a projecting position, and when desired they can be held down out of the way.

A bicycle saddle has been patented by Mr. Robert E. Humphreys, of Irwin, Pa. This invention consists in the combination, with a curved piece, of a spring rod secured and bent to form the supporting springs and horn, making a saddle which will rock forward and back, up and down, and laterally.

A calcimine compound has been patented by Messrs. Samuel U. Brunck and George A. Marsh, Jr., of Sandusky, Ohio. It consists of calcined plaster, cotton seed oil, and water, formed into a paste and afterward dried and ground, for mixing with dry powdered calcimine or other like wall finish materials.

A pencil sharpener has been patented by Mr. Azel Hatch, of Lexington, Ky. This invention covers a broad flat file, with a beveled surface on either of its sides, the broad portion being of a coarse file cut, and the beveled surfaces finer, to rapidly cut away and afterward give a smoother finish to the pencil point.

A calf weaner has been patented by Mr. Edward P. Henry, of Eagle Rock, Idaho Ter. It is for attachment on the nose of a calf, and consists of two plates pivoted to each other at the edges, each plate having a curved prong at the upper inner corner, preventing the calf from sucking, but permitting it to eat grass.

A package has been patented by Mr. James McCrodden, of New York city. Its body is cylindrical, made of straight staves, the lower ends adapted to receive a head and the upper ends beveled to receive a cover, the outer surface to be covered by paper or pasteboard, and the whole making a package especially fitted for grocer's use.

A peach stoner has been patented by Mr. Cager Hardgrave, of Clarksville, Ark. It has vertically standing steel blades to split the peach, and spoon shaped blades acting in connection therewith to open the peach, with other novel features, whereby peaches may be halved and freed of their stones quickly and neatly.

A boot or shoe protector has been patented by Messrs. Thomas Gribble and Robert Abraham, of Calumet, Mich. It consists of a malleable metal bottom plate with studs, and formed with side and toe flanges, which inclose the sole edge and the lower portion of the upper, the invention being especially applicable for miner's boots.

A grinding mill has been patented by Mr. Henry Cutler, of North Wilbraham, Mass. This invention relates to portable mills of the vertical disk type, and provides novel means for the accurate setting and adjustment of the stones to compensate for their wear and to allow of the stationary stone being dressed without removal from the case.

A bridle blind has been patented by Mr. Emory Q. Darr, of Shelbyville, Ind. It is made with a marginal stiffening wire, with a projecting loop to receive the winker stay, and with a stiffening plate pocketed between the facings of the blind and separated from the wire by a row of stitches, all the stitching being done before the plate is put in place.

A gin saw gummer has been patented by Mr. Wesley F. Collie, of Barren Fork, Ark. Combined with a handle is a cross bar integral therewith, and flat teeth riveted to the under side of the bar, and beveled or pointed at their outer ends, the implement being used by slipping it in between the saws while the motion of the latter is reversed.

A method of forming packages of paper has been patented by Mr. Willis M. Hunt, of Glen Gardner, N. J. It consists in providing the bags in corresponding edges with slits, and placing therein a cord covered with glue or other adhesive material, so the bags can be readily pulled from the package, and the package hangs well, occupying little space.

A flat wire netting has been patented by Mr. Emil Rattey, of New York city. It is formed of a series of flat wires or rods woven together, so that at the intersections each wire is bent to form a part which is at right angles to the remaining part of the wire or rod, the netting to be used for office railing, window screens, etc.

A machine for removing snow and ice from sidewalks has been patented by Mr. Edmund R. Angell, of Derry, N. H. It is made with wheels, axle, and handle, and a spring held shovel hinged to a bail rigidly attached to the axle, a cylinder with cutters being connected with the drive wheels whereby ice and crust can be readily loosened.

A combined blackboard and desk has been patented by Messrs. James G. Smith and Hiram E. Butter, of Jamestown, N. Y. The construction is such that the combined article when open may be used as a writing desk and when closed as a blackboard, the board forming the table to the desk when open, and front or door of the desk when closed.

A pencil sharpener has been patented by Mr. Eugene Fitch, of Des Moines, Iowa. Combined with a shell or hollow head is a knife held within its sides, and a clamping spring and handle, with other novel features, making a device which can be conveniently held and manipulated, and will be very securely held on the pencil when not in use for sharpening.

An ointment for the cure of diseases of the hair or scalp has been patented by Mr. Daniel M Allen, of Fort Wayne, Ind. It is composed of Peru balsam, benzoic acid, oil of cloves, alcohol, creosote, iodine, iodide of potassium, water, vaseline, and calcined magnesia, the ointment to be applied by means of the finger on the scalp.

An apparatus for taking soundings has been patented by Mr. Herman Schoening, of Antwerp, Belgium. The construction is such that as the apparatus is lowered in the water the water rises in a groove and compresses air in proportion to the depth to which the apparatus is lowered, this being indicated by a properly prepared gauge strip to be affected by the wetting.

A thill coupling has been patented by Messrs. Benjamin C. Smith and Charles W. Pride, of Boston, Mass. It has a specially devised frame attached to the axle of the vehicle by a clip, with other novel features which allow of easy coupling and uncoupling, while it cannot be uncoupled when the vehicle is in motion, and is neat and compact.

A spindle for cap spinning and twisting machines has been patented by Mr. William Wardman, of Bristol, Pa. The construction is such that the bobbin can be made longer and have a longer traverse than heretofore, so as to hold more yarn and increase the amount of work done by the machine, as well as improve the quality and lessen the expense.

A bottle cork attachment has been patented by Mr. John W. Hayward, of St. Johns, Newfoundland. Combined with a cord having slits on its sides is a cord or band in these slits, and passed over the inner end of the cork, so the cork can be readily removed without a corkscrew, or the attachment may be used as a seal to tie the cork in the bottle.

An adjustable window screen has been patented by Messrs. Forest M. Lampson and George W. Hogben, of Ripon, Wis. The screen frame has staples and strips arranged at the side of its end portions, headed pins being secured in the strips and working in the staples, the device being intended to fit screens to window frames of different widths.

A washing machine has been patented by Mr. James S. Jones, of Crutchfield, Ky. It consists of a tank in which is hung a drum that is made to oscillate and dip in the water of the tank, the head of the drum carrying a series of internal ribs, and the drum carrying pins for separating the clothes and prevent them from falling down in a solid mass.

An animal trap has been patented by Mr. Sylvester S. Green, of Lead City, Dakota Ter. It is made with a box having a platform and a trap door supported by a spring held lever, engaging a crank driven by a cord and weight, the crank working in a slotted cross head at the inner end, the device working to project the animal caught into a secure inner chamber.

A coal and rock drill has been patented by Mr. James F. Loftus, of Winton, Pa. It is adapted to bore or drill holes horizontally, perpendicularly, or at any desired angle, and is an improvement on that class of drilling machines in which the stem or shank of the drill proper is screw threaded and works through a nut hinged or swiveled to a suitable support.

An aerial railway and car has been patented by Mr. Andrew J. Morrison, of Buffalo, N. Y. It consists of a wire cable supported at intervals by balloons anchored to the earth, a car being suspended from the cable and made to travel thereon by its own gravity, the balloons being arranged to raise and lower the cables so as to give them the proper inclination.

A carpet stretcher has been patented by Mr. George M. Robison, of Leadville, Col. Combined with a plate having teeth on its front edge is a swinging piece above the teeth, a rack bar resting on the plate with a pin on one end, a pawl spring on the plate, and a handle piece for moving the plate and pressing the swinging piece upon the teeth, with other novel features.

A rod and bolt clipper has been patented by Mr. Harry W. Parker, of Omaha, Neb. The stock has a fixed lever with a vertical end aperture opposite a bent hook forming a cutting edge near its outer end; in connection therewith is pivoted a movable lever to move a cutting blade along a cavity, so that its cutting edge will operate with that of the bent hook, to cut wires, bolts, etc.

A fire screen hinge has been patented by Mr. James M. B. Robinson, of New York city. It is made with plates having horizontal slots, vertical recesses, and rounded outer edges, with bolts and nuts, and a connecting plate fitting into the slots of the hinge plates, with pins working in their recesses, whereby the edges of the plates will be kept in contact with each other as the hinges are worked.

A mechanical telephone has been patented by Mr. Francis R. Shaw, of Chatham Center, O. Combined with a diaphragm of fibrous material, having small loops held on its back, are fibrous line wire connecting strips, crossing each other and having their ends secured to the loops, the design being to avoid the harsh metallic ring produced by connections of metal between the line wire and the diaphragm.

NEW BOOKS AND PUBLICATIONS.

LOUIS AGASSIZ: HIS LIFE AND CORRESPONDENCE. Edited by Elizabeth Cary Agassiz. 2 vols., pp. 794. Boston: Houghton, Mifflin & Co.

Although Professor Agassiz was among the greatest of American naturalists, he already had a wide reputation in this field before coming to America in 1846, when he was 39 years old. He was of French descent, born at Motiers, Switzerland, and from his 20th year, while yet a student at the University of Munich, to the end of his life, in 1873, his name occupied a place of steadily growing prominence among the leading naturalists of this century, such as Humboldt, Cuvier, Buckland, Owen, and Murchison. Beginning with the organization of plants and their geographical distribution, he afterward took up the history of fresh and salt water fishes, and in 1833 began the publication of his great work of five volumes on fossil fishes, which was followed by numerous volumes on history and geology, including special studies of glaciers. From 1846 his biography belongs more particularly to the scientific history of the United States. The principal object of his coming here was to study the natural history and geology of the country, as well as to deliver a course of Lowell lectures in Boston. To further his aims, Professor Bache, of the Coast Survey, invited him to use the facilities of that department, to visit every point of the coast in its well equipped vessels. Agassiz deemed this offer so liberal, and of such importance in a scientific point of view, that it had great weight in determining him to remain to the end of his days in the United States; and he accordingly, in 1847, accepted a professorship in the Cambridge Scientific School, founded by Mr. Abbot Lawrence. What he subsequently accomplished is matter of too recent history to call for special mention here, but its influence in stimulating thorough scientific examination in the United States has been profound and far reaching. The two volumes now published by Mrs. Agassiz afford a most charming biography of her distinguished husband, with just enough about the many great works in which he was engaged to be intensely interesting, without ever becoming tedious. These references are, in fact, principally in the letters of eminent men, the correspondence with Humboldt alone giving the means for a fairly comprehensive review of the most important work undertaken by Agassiz, while the biographical portions show the difficulties under which he worked, his great perseverance and indefatigable industry, and well depict the engaging personality of one who for the last half century has occupied a large place among original workers for the advancement of science.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Information requests on matters of personal rather than general interest, and requests for **Prompt Answers by Letter,** should be accompanied with remittance of $1 to $5, according to the subject, as we cannot be expected to perform such service without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) B. S. H. asks: 1. What are the ingredients used in flavoring the best smoking tobacco? A. Various flavoring mixtures are made and sold in New York. Cristiani's "Perfumery and Kindred Arts" gives a number of recipes such as the following:

Tincture of cascarilla	6	ounces.
" " tonqua	4	"
" " tolu	2	"
" " orris	2	"
" " valerian	2	"
Oil of nutmegs	⅜	"
" " cloves	¼	"
" " rhodium	1	drachm.

2. There was a circus here some time since in which a girl walked on a ceiling, apparently of board, in an inverted position. By what means was it accomplished? A. The walking is accomplished by means of electro-magnets. A patent for this purpose has recently been issued, a copy of which we can send to you for 25 cents.

(2) G. W. asks what mercury can be thoroughly dissolved with. A. Nitric acid, even when dilute and in the cold, dissolves it freely.

(3) J. H. L. desires a receipt for frosting silver jewelry. A. Dip the article in a solution of nitric acid and water, half and half, for a few minutes, then wash well in clean water and dry in hot sawdust. When thoroughly dry, brush the sawdust away with a soft brush, and varnish the parts required to be bright.

(4) A. C. asks at what point along the Atlantic coast the Gulf Stream approaches the nearest. A. Cape Hatteras.

(5) L. C. B. writes: Will you please tell me how diastase may be obtained? A. A cold infusion of malt is heated to 158° Fah. (to coagulate its albumen); it is then allowed to cool, and alcohol is added to the filtered liquid, when diastase is precipitated under the form of a tasteless white powder which is freely soluble in water.

(6) J. L. H. writes: I wish to make a propeller 20 inches in diameter. From which could I obtain the most speed—from a 2 horse power engine, one of 3 flukes or one with 2 flukes? The boat is 25 feet over all, 20 feet keel, 3 feet deep, and 5½ beam. A. 3 flukes are generally used, and considered the most efficient.

(7) J. P. K.—The addition of a little oil of cloves will prevent mucilage from souring. Salicylic acid, and sometimes carbolic acid, are similarly used. You will find in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157, numerous recipes for inks.

(8) H. C. F.—For long and short reach vehicles of the same weight, both being under the same conditions on a level road, there could be no perceptible difference in their pull; but on uneven roads the long reach vehicle is easier and less jerky upon the horses. This is very perceptible in drawing long timber on rough roads.

(9) F. W. S. asks whether any one has ever used a continuous screw for propelling boats—a screw 10 feet or 20 feet long. A. The continuous screw was tried in the early experiments with screw propulsion, and found worthless.

(10) P. T. C. asks for a solution to prevent the colors of embroidery on white silk handkerchiefs fading in washing. A. Before washing it is recommended to soak the articles for some time in water, to every gallon of which is added a spoonful of ox gall. Alum added in small quantities to the wash water is also used to prevent fading.

(11) M. C. asks: What is the best preparation used by draughtsmen for whitening boxwood blocks previous to making drawings? (Blocks used by wood engravers.) A. Every draughtsman has his fancy for one or another of the many whites, with varieties of gums. Our artists find good satisfaction in cake flaked white or bottled Chinese white.

(12) G. W. F. asks: Is there any better way to obtain a due east and west course than by turning a right angle from the true north and south as obtained by observing the North Star? If this is sufficient, is the mean of repeated angles with a Buff and Berger transit (4½ inch needle) sufficiently accurate to run such a line sixty miles in length, a boundary between States? A. A due east and west line in your latitude is not a straight line, but rather a great curve in which every part shall be at a right angle with the polar axis, and whose absolute radius shall be the least distance from the given point in latitude to the earth's axis. The curve on the plane of the given latitude should have a radius equal to the distance on that plane extended to meet the polar axis, so that, to run a due east or west boundary for 60 or more miles, offsets for tangential departure from the great circle should be made, and a new meridian established for each section of from 5 to 10 miles. This equation forms one of the difficulties encountered in rearranging boundary surveys that were originally described by compass courses.

(13) E. B. asks: 1. Can a static machine be substituted for a battery of cells for galvanoplasty? A. No. 2. The reason why? A. Because galvanoplastic operations require a current of great quantity with low intensity. The electricity of the static machine has a very high tension, but very little quantity.

(14) H. S. asks: Why do the eyes of a portrait appear to follow a person around the room? A. The surface upon which the features are outlined being flat, no matter at what angle they are observed, we see the same flat delineation, the lines always bearing the same relation to each other.

(15) R. J. P. writes: I would like you to answer in your columns a few questions in regard to the dynamo described in SUPPLEMENT, No. 161. 1. Will it answer to have the magnet and armature cast from the same iron, if it is soft, as used in a machine shop, or would it be better to have the magnet cast, and to make the armature of soft wrought iron? A. Both magnet and armature may be made of soft cast iron. 2. Are Nos. 14 and 16 wire the best, where machine is to be used for plating, and run by power? A. These numbers are correct, but coarser wire may be used if desirable. 3. How fast should it run to get the best results? A. From 1,500 to 2,000 revolutions per minute. 4. Could the machine be used to run a small light, if wound with coarse wire? How many gallons of solution will it operate, or how much nickel will it deposit in an hour? A. Yes, if the lamp has a very low resistance. The questions regarding the solution must be settled by trial.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated.

F. R. S.—The specimen of clay sent is useful for the manufacture of the commoner grades of earthenware. It brings $1.35 a ton at Amboy and $1.50 at New York. We would suggest your sending samples to the potteries at Liverpool, Ohio.—G. W. S.—The mineral is an arsenical iron ore, known mineralogically as mispickle. It is of no commercial value, as arsenic is only smelted as a by-product.

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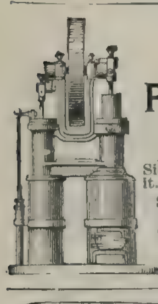

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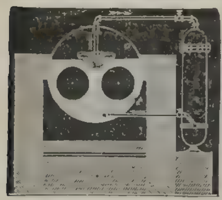

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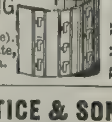

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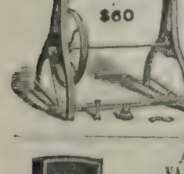

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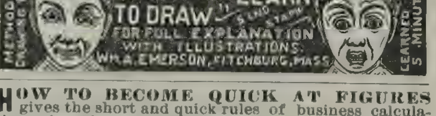

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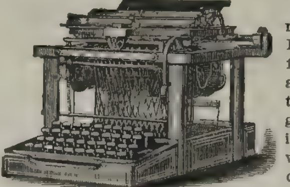

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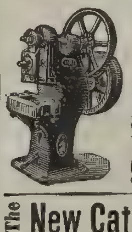

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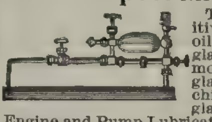

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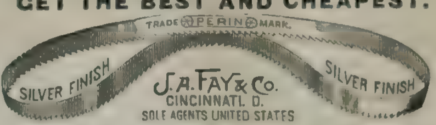

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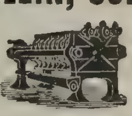

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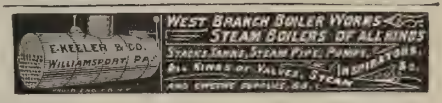

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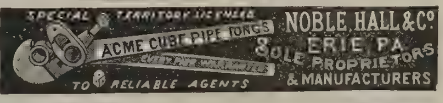

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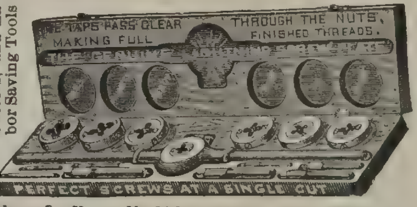

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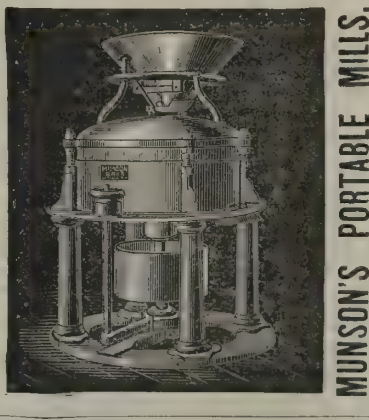

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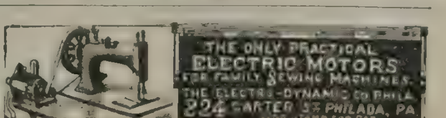

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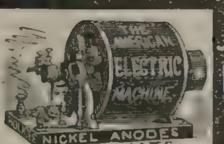

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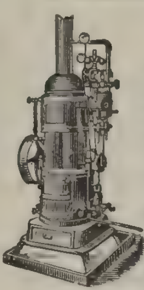

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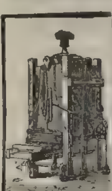

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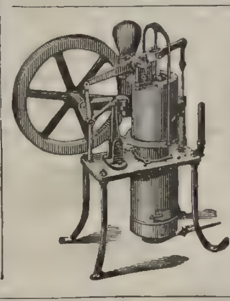

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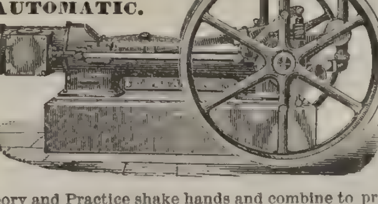

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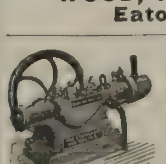

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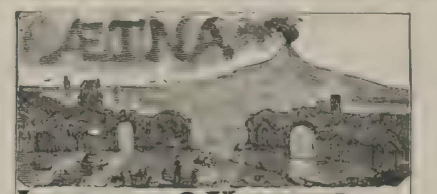

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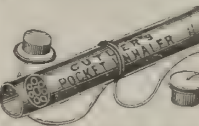

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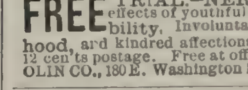

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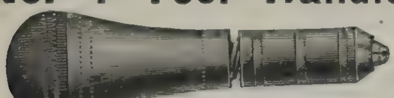

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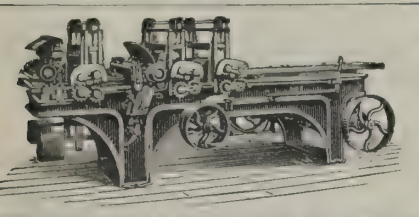

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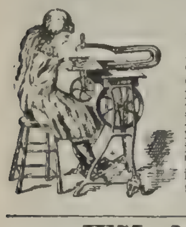

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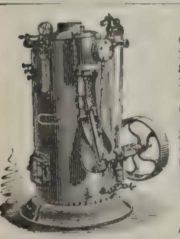

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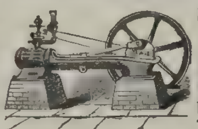

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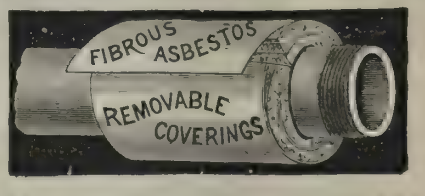

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A VILLAGE RESIDENCE.

BY O. P. HATFIELD, ARCHITECT, NEW YORK.

[With two colored plates and a large sheet of details as supplements to the November number of the SCIENTIFIC AMERICAN, Architects' and Builders' Edition.]

SPECIFICATIONS AND ESTIMATE FOR A VILLAGE RESIDENCE.

Specifications.

Mason:

Make excavations as required for cellar, for trenches, area, etc., and deposit and grade the excavated material upon the premises where shown; reserve the soil for top grading.

Carry up the walls of the cellar to grade line as shown, 18 inches thick, of good building stone laid in best cement mortar; the walls well bonded and exposed faces hammer dressed. The area walls to be of like description; and foundations of like stonework provided under the piazza walls and piers, commenced 3½ feet below the grade line. Place proper bottom stone under girder posts.

Erect cellar walls above grade line 12 inches thick, of good common hard brick laid with best lime and sand mortar, and faced with Haverstraw brick neatly laid. Chimneys erected in the same manner and faced above roof with Colabar pressed brick, neatly laid in red mortar. The fireplaces faced and paved with pressed buff brick.

Cellar window sills, door sill, area steps and coping, and chimney caps of blue stone; the sills axed or planed, as also the edges of chimney caps; the other stone cut neatly to size. Steps, 4 by 12 inches on hard brick; coping, 3 by 12. Caps, 3 inches thick. Blue stone flagging in front of principal entrance steps, 3½ by 6 feet.

Fill in the beams of second story floor between ends thereof with a 4 inch brick wall laid in mortar.

Lath and plaster the apartments, halls, and passages of the first and second stories with two good coats of lime, sand, and hair mortar, and well hard-finish the same. Run appropriate stucco cornices in parlor, dining room, and hall of first story.

Provide hearths and facings for three fireplaces of buff glazed tiles, neatly laid, and five stovepipe rings and covers.

The circular wall under the piazza balconies to be of the same description of material as the piers, and 8 inches thick.

Carpenter:

Provide the timber of frame of spruce. Floor beams of the first and second stories, 2 by 10 inches, 16 inches from centers. Girders in cellar, 6 by 8 inches on 8 by 8 inch posts. The principal posts of frame, 4 by 6 inches; girts, plates, sills, and interties, 4 by 6; filling-in studs, 2 by 4 inches and 12 inches from centers; braces, 2 by 4 inches; rafters, 2 by 8 inches, supported at center upon partitions, and placed 2 feet from centers. Piazza floor beams, 2 by 8 inches, 2 feet from centers. Plank bridging in floors.

Set partitions with 2 by 4 inch hemlock studs, 12 ins. from centers; door studs doubled. Ceiling of second story of 2 by 4 inch spruce 16 inches from centers, braced to rafters. Partition studs bridged with plank bridging. Furring for plastering as required.

Cover the frame and roofs with milled hemlock sheathing boards, laid diagonally and well nailed. Finish the lower part of the house upon the sheathing with 5 inch clear siding, and the upper portion thereof as shown with clear pine shingles, cut to a point and taken to a width, and planed smooth on the face. The siding and upright shingles laid upon stout felt paper. Cover roof boards with pine shingles laid plain 5 ins. to the weather. Flash all junctions with I.C. charcoal tin painted on the lower side, and line all gutters with the same, the whole made proof against leaking. Provide leaders of double tin to convey roof water to drains as required.

Form all cornices, corner boards, water tables, belt courses, upright stiles, and rails for clapboard frames, dormer trimmings, ridge moulds, etc., on exterior of house, of plank and boards to correspond with the drawings, and mould the same as shown.

Construct the piazzas with turned posts and balusters, moulded rails, etc., as shown. Piazza rafters, 2 by 5 inches, of clear pine planed smooth and chamfered; the roof boards of ⅞ inch strips 4½ inches wide, milled and beaded, and laid with the smooth side down. The piazza roofs covered with the tin above specified, well soldered and secured, and with like gutters and leaders.

Provide windows with box frames properly moulded; sashes 1½ inches thick, glazed with best sheet glass, double thick in the lower sash, and hung with hemp cord and balance weights. Windows to piazzas to have casement sashes as shown, well hung and fastened. The cellar windows hung at ceiling. Windows above the basement provided with 1⅛ inch Venetian shutter blinds with roller slats, etc. Sash and blind hinges and fastenings, as required.

Furnish and lay floors of 1st and 2d stories of ⅞ inch milled white pine strips, 4½ inches wide and blind nailed. Piazza floors of same description, but the strips 1¼ inches thick and 3 inches wide. Underlay first floor with stout felt paper.

Front entrance door two inches thick, the other principal doors 1½ inches thick, and closet doors 1¼ inches. The latter with reversed bevel rim locks; all other doors with appropriate mortise locks and porcelain furniture. All doors with proper hinges, outside doors with bolts; door saddles and stops of walnut. Inside doors paneled and neatly moulded.

Case all doors and windows, and provide bases in first and second stories, as shown. Wainscot kitchen three feet high with ½ inch milled and beaded Georgia pine strips 3 inches wide, and capped with walnut moulding. Shelve all closets and provide clothes hooks, as required. Provide a large hanging shelf in cellar.

The stairs to be erected with white pine plank steps, fascias and strings, board risers with cove moulding, and well timbered. Rail 4 inch, moulded, on 1¾ inch fancy turned balusters and newels; the rails, balusters, and newels of ash stained and varnished. Steps to piazzas, etc., of white pine as shown. Step ladder to cellar of two inch spruce, dadoed together.

Paint all woodwork usually painted, including shingles of roof, etc., and ironwork, with three good coats of Atlantic white lead in linseed oil, colored as required. Interior work in two tints—walnut and Georgia pine oiled and shellac varnished. The tinwork to have two coats of Prince's metallic paint. Piazza floors and steps, and center of stair steps, included in the painting.

The materials all of good quality; the lumber of white pine, unless otherwise specified, and well seasoned. The doors and the exposed parts of the trimmings throughout to be of clear stuff. Piazza floors clear, others of merchantable stuff. The work executed in the best manner.

Plumber:

To provide kitchen sink, range with waterback, iron boiler, kitchen pump, tank over second story, bathtub, water closet; with all pipes, faucets, gas pipes, etc., complete; to an extent of cost not exceeding $350, and as selected by the owner.

MR. O. P. HATFIELD, *Architect*, 31 Pine Street:

We will agree to erect modern dwelling, complete, according to plans and specifications made by you, for the sum of four thousand four hundred dollars ($4,400).

S. V. HOLLISTER & SON.

New York, October 17, 1885.

A Special Suggestion.

By reference to the terms of subscription published elsewhere, it will be seen that this Architects' and Builders' edition of the SCIENTIFIC AMERICAN is furnished to subscribers at the low price of a dollar and a half a year for single copies, and in clubs at a still less rate, namely, four copies for five dollars.

With a very little trouble, it seems to us, each person who receives a copy of our paper might readily secure a club of four among his friends. Everybody is more or less interested in buildings and architecture. In every town there is always a large number of persons who are thinking of building a home, some time or other; and they are glad to have plans and designs in their possession. The number and variety of architectural illustrations presented to subscribers in our pages during the year will be very large, and the value to the reader will doubtless be a hundredfold more than the cost of subscription.

Now is the time to subscribe. We hope each one of our readers will send in a club of at least four names. The more the better. It would be difficult to select for a friend a more acceptable or useful present for Christmas or the new year than a paid subscription to this paper.

Items Relating to Building Progress.

We shall be glad to receive from architects and builders, in all parts of the country, information relating to the erection of new buildings, such as dwellings, stores, churches, schools, halls, etc. The location, character of the building, the expected cost, together with the names of the architects, builders, or contractors, should be given. Particulars of public works are also in order.

As this paper circulates largely in all cities and towns where building is going on, the advantage to architects and builders in having their names appear will be obvious. We hope all who receive this number will respond without delay, sending by letter or postal card items such as we have indicated.

Plans and Contributions.

Architects and builders who are disposed to furnish tasteful designs of buildings and their details for publication in this journal, or who desire to contribute by their writings to our pages, are invited to present suggestions. The editor will at all times be glad to hear from them, and will expect to make satisfactory compensation for such contributions as may be used. No newspaper of the same class has so great a circulation as this; contributors will have the satisfaction of appearing before a very large audience.

Our Colored Drawings and Sheet of Details.

We send out with this November number of the Architects' and Builders' edition of the SCIENTIFIC AMERICAN a sheet of colored drawings and an accompanying sheet of details, containing an excellent design for a residence which may be built for $4,400. This is a contribution to our pages by Mr. O. P. Hatfield, the well known architect, No. 31 Pine St., New York. In another column will be found a specification and estimates for the erection of this building. Those who desire further information should address the architect.

We have in preparation a variety of new and superior designs for residences and other buildings, some of very moderate cost, others elaborate and more expensive, which will be duly published, forming a most attractive and valuable series. Those who wish to possess the same should promptly enroll their names as regular subscribers. The price is only $1.50 a year for a single subscription, or a club of four copies for $5 a year.

Fireproof Building in New York.

BY T. M. CLARK.

In the construction of buildings intended to be thoroughly fireproof, New York stands in advance of the whole world. London, Paris, Berlin, and Vienna contain some really fireproof buildings, with floors vaulted in brick, heavy walls, and small windows; and many others ostensibly fireproof, with plaster floors held up by a light frame of iron, everywhere exposed, and constantly liable, if attacked by the heat of a pile of burning goods, to a disastrous collapse, like that which destroyed in a few minutes one of the largest stores in Paris a year ago; but New York alone can show many buildings thoroughly light and airy, in which it is impossible for a destructive fire to occur. The essence of these buildings is, as it must be with our present materials, a structure of protected ironwork in which the whole framework is cased with terra cotta.

The details of this sort of fireproof work have undergone a good deal of modification within a few years, although the principles have not been changed. Not long ago a concrete of cinder and plaster was in high repute for filling between floor beams, for partitions, for furring outside walls, and even for protecting iron, and various other concretes were much employed. These have proved, however, to be liable to crumbling from fire and water, and burnt clay is fast taking their place for all purposes. For furring, or lining outside walls, to keep the dampness of the brickwork from the rooms, the porous terra cotta, or terra cotta lumber, made by mixing saw dust with fire clay, and baking it at a heat high enough to burn out the saw dust, leaving a hard, spongy mass, is much preferred to the old fashioned concretes; and the same form of burnt clay is used in thin blocks for forming partitions, which are so light as not to burn the floors, and at the same time strong and absolutely fireproof, alternate heating to redness and saturating with water, many times repeated, having almost no effect upon it. For floors, burnt clay is now universally used in the shape of blocks, made hollow to save weight, and tapered so as to form a flat arch, which has all the strength required, and has the great advantage of presenting a level surface beneath, which is corrugated to receive directly the plaster of the ceiling. The old fashioned brick arches turned upon the lower flanges of iron beams have now entirely disappeared from ordinary work, except for carrying sidewalks over coal vaults. To say nothing of the unpleasant appearance presented by a ceiling broken up into long parallel ridges, this construction, as usually seen, leaves the lower flanges of the iron beams exposed to heat from burning material in the room, thus violating the first principle of fireproof construction as now practiced; and the attempts made in former times to support a flat ceiling below the arches by means of iron lath have always been very costly and unsatisfactory.

In the matter of protecting the lower flange of the beams, even the construction of flat arches of hollow blocks was not at first very successful. As will be seen from the upper diagram, in plastering on the under side of the blocks a space equal to the width of the lower flange of the beam, often four or five inches, had to be spanned by the mortar, with nothing to hold it against the iron. In this position it was likely to break away, especially in case of fire, leaving the iron exposed, and the latter blocks are made to hang a little below the beam, forming by their shape a dovetailed channel, in which a slip of terra cotta is laid, when the pieces are put together, and is thus held securely. This gives perfect protection, but is a little troublesome, and the very latest blocks are made with projections wide enough to meet beneath the flange of the beam without the insertion of a slip. These blocks are as readily put in place as the primitive sort, and cover the beams securely from fire as soon as they are set. Common as these blocks are now in New York, being the universal material for flooring in all new banks and office buildings, to

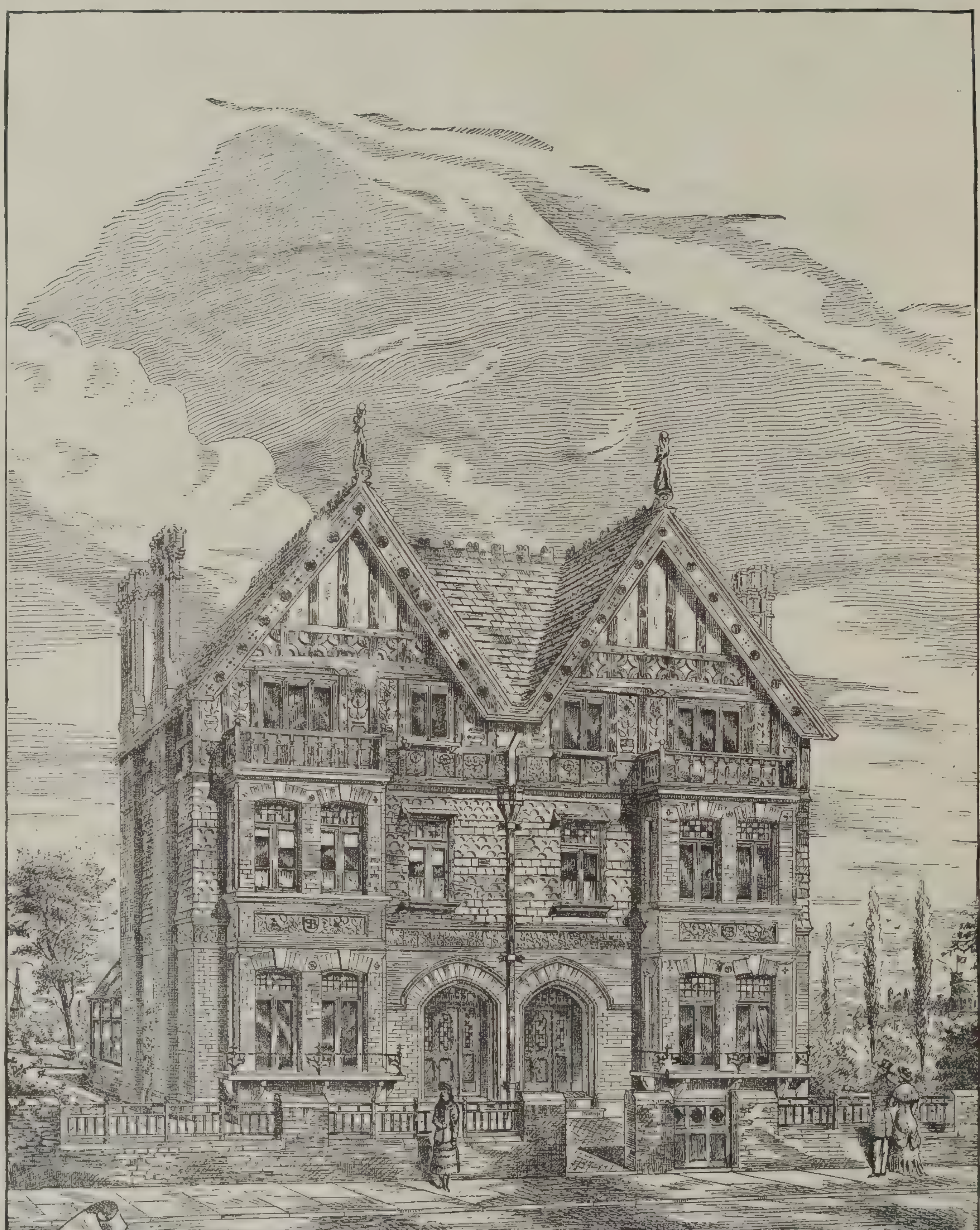
gether with all the first class apartment houses, and many private dwellings, they are as yet hardly known elsewhere, unless in Chicago, where fireproof building is practiced with great success. Even in New York their use dates from very recent times, and it is said that in the construction of a building on Broadway, finished about four years ago, in which the architect required the floors to be laid with them, the masons, employed by one of the best contractors in the city, set them alternately up side down, so that they fell out when the staging was taken away from beneath them.

In England, the idea of the best architects is to obtain the effects they wish in fireproof construction by the use of concrete. They have an excellent material in their Portland cement, and, by adding sulphur to it, the concrete made with it is rendered partially fire resisting, by the lessening of its tendency to crack and crumble under the action of fire and water; but no concrete construction yet invented approaches, in the facility with which the materials are handled, the quickness with which the work is completed and the staging shifted to another place, or in the perfect security which it gives, that with the terra cotta hollow blocks. By the help of these, and of the porous terra cotta partition and furring blocks, a house with wide openings, floors ten inches thick from the level ceiling to the top of finished flooring, and partitions occupying different positions in the various stories, can be made just as secure against fire as a French or German storehouse, with its ponderous division walls extending from cellar to roof, and its vaulted ceilings two or three feet high from the spring to the crown.

ASPHALT ROOFS.

In describing a floor of a New York fireproof building, we describe also the roof, which is made in exactly the same way as a floor, with iron beams, filled in and protected by hollow terra cotta blocks, which are then leveled up with concrete, two, three, or four thicknesses of asphalted felt laid on the top, and the whole then covered nearly or quite an inch thick with rock asphalt, precisely like that used for paving the streets of Paris, and put on in the same way. Once put down on a sufficiently rigid framework of beams, such a roof is as permanent as the building itself. The heat of the sun does not affect it, water runs off it as from a granite slab, and the movement upon it, even of horses and carriages, would deteriorate it very slowly, if at all. With these roofs, the flashings, even though of copper, are the weakest part; and in the latest of the great fireproof office buildings the flashings themselves are replaced by great slabs of rubbed slate set vertically around the parapet walls, the lower edges of which are embedded in the concrete, while the wall itself is built out over the upper edge, holding it like a panel. It is difficult to see where the deterioration of a structure like this could begin. Centuries must elapse before either the asphalt roof covering or the slate flashings would decay far enough to admit water to the interior, and extravagantly costly as the construction appears, it will probably be economical in the end.

It is usual in all these fireproof buildings to lay a wooden floor for comfort in walking, and this is now universally put on wooden sleepers, which lie on top of the terra cotta blocks, and are held in place by having their ends so shaped that they can be wedged under the upper flanges of the iron beams. After these are in place, the space between them is entirely filled with cinders, and the wooden flooring is then nailed down. By filling the intervals between the sleepers with cinders, the circulation of air under the floor is prevented; and although it would perhaps be possible to burn a hole in the wooden floor by building a fire upon it, the fire could not spread, and experience shows that the currents of air around a fire draw so strongly upward that there would be no danger of heating the iron beams in this way sufficiently to do any harm; while the cinder-filled space, three or four inches in depth, affords an opportunity for carrying steam and water pipes under the floor from one part of a room to another, as is generally necessary in apartment houses and office buildings.—From a paper read before the Society of Arts, Boston, Mass.



Weather Joints.

The importance to be attached to the minor details of building is sadly overlooked by architects and builders. Let us take, for instance, wall building. By attending to one or two small matters which are often neglected, a great deal of trouble and discomfort might be saved. We here allude to weather jointing. The joints are often made level, or are so formed as to invite the penetration of moisture. By simply beveling the joint by the trowel on the outer face, the water that runs down the wall will be thrown off instead of soaking into the joints. Other little details have reference to the sections of mouldings, cornices, and stringcourses. In all these details it is very easy to make proper weatherings and throatings, though in a large number of buildings we find them neglected. The results are not only the penetration of moisture into the rooms, but a disfigurement of the external face of the wall. How often do we see cement mouldings and cornices or window heads actually the means of defacing the wall by the unsightly streaks of rain which, trickling down the brickwork, quickly spoil the cleanliness of the front. Window cornices, and even such small details as architrave caps and stringcourses, ought to be throated by a small groove sunk beneath the projecting member before the face of the wall. The "drip" should be constantly borne in mind in the design of external details, though in cement, and even in stonework, we find it frequently omitted in buildings of a superior class.

In speaking of weather joints, allusion may be made to the value of checks in windows and doors. The stone sill is generally throated, and a metal water bar inserted between it and the wooden sill of the sash, though how such work is managed in the smaller class of houses no one knows. The double-sunk sill is more in name than in reality. There is seldom a groove run between the rebates. In casement windows we find sills very commonly made without the necessary precautions, the lower rail of casement is only rebated instead of being throated outside to throw off the water beyond the joint, and there is no perforation from the inside of the sill to the outside to carry away moisture that may enter. There are so many excellent patented weather bars and contrivances for keeping out wet in the market, that the builder is to blame for gross apathy and negligence if even the commonest tenement is unprovided with weather joints of the kind we have described. Those who are going into new houses are too often ignorant of these necessary expedients for insuring comfort.—*Building News.*

A New Portable Desk.

A patent has been granted to Chas. Newbourg, of Brooklyn, N. Y., for a portable desk. It is a neatly constructed device made of two boards, and so arranged that it can be attached by one motion to any bench, pew, or chair, and is provided with space for carrying stationery, etc., and when folded up can be carried about in the pocket. It will be found very useful to stenographers, reporters, and others, when at places of public meeting, by attaching it to the bench, chair, or pew in front, and also to business men and others, when in railroad cars or other vehicles, as it forms a steady support, and thereby conducts to legibility. Commercial travelers, doctors, and invalids who are unable to move to a fixed table or desk, and clerks in offices where room is restricted, will likewise find it very serviceable and convenient to make their memorandums and writings upon. Its use, however, is not restricted to any class of persons for either writing purposes or as a music stand, or desk, or counter, or other like extension, and when not in use it can readily be taken down. It may be used on the knees or on the table as a simple desk having an inclined top, or writing or reading surface.

Exhibition of Architectural Drawings.

The first exhibition of Architectural Drawings is announced in connection with that of the Salmagundi for this winter, opening January 11 and closing February 1.

Drawings will be received at the American Art Gallery, 6 East Twenty-third Street, from December 31 to January 4, 1886, and by Louis R. Menger, 35 Dey Street.

An exhibition of this kind should work great good to American architectural draughtsmen by increasing the number of men capable of making such drawings and elevating their standard of rendering, both of which are objects to be attained. As an exhibition of the tendency of current work, it will prove as attractive to the layman as to the practitioner. It is in charge of a committee of architects in this city, among their number appearing the names of Prof. William E. Ware and Messrs. Richard M. Hunt, Frederick C. Withers, R. H. Robertson, with Mr. F. A. Wright, 149 Broadway, as Secretary.

There are sub-committees in Boston, Chicago, and Philadelphia.

MOVABLE STRUCTURES FOR FAIRS, MARKETS, ETC.

We herewith present illustrations of the movable Flower Markets of Paris, which by their economy of construction and completeness of adaptation for the purpose have given much satisfaction. For markets, fairs, seaside resorts, etc., such structures appear to be particularly desirable. From the designs here given builders may perhaps derive useful practical hints.

With movable markets, a town or city can utilize large areas of unproductive ground, and find new resources, although renting the stalls at a minimum price. The expense connected with the structure itself is very small. In fact, the distinguishing character of such structures is their portability—so that the same shed can be used in any number of different places.

The principal expense, then, will be for carriage; but it is easy to see that there will always be an economy in their use. This is a fact, moreover, that practice has verified, for it is well known that Paris does not get her expenses back from her stationary markets, while the movable ones yield a revenue.

On another hand, as stationary markets are costly, it results that they cannot be multiplied as much as necessary, and so a portion of the inhabitants are daily subjected to a loss of time in reaching the one nearest them.

Finally, from a hygienic standpoint, movable markets present a very great advantage over stationary ones. The latter, in fact, notwithstanding their large open spaces, never get rid of the vitiated air that they contain, and the bad odors that emanate from them are also a source of annoyance and danger to the neighborhood. In movable ones, on the contrary, when the structure is taken apart, the air, sun, and rain disperse all bad odors, and the place is rendered wholesome in an instant.

It is easy to see that well established structures of this kind would render great services in small towns also. They might entirely replace stationary iron markets, the high cost of which often causes municipalities to preserve their old, inconvenient, and unhealthy structures. As a general thing, market is held but once or twice a week in small towns. In the interim the structure could be taken apart, and the place rendered free.

The question, then, is to have a system of construction that shall satisfy the different parts of the programme that we have just laid out, that is to say, strength, lightness, rapidity of erection, and ease of carriage. The shelters that are at present employed for movable markets at Paris are very primitive, and are wanting in solidity and convenience. They consist simply of wooden uprights to which are affixed crosspieces that support an impermeable canvas.

In order to render it possible to extend the system of movable markets, it became necessary to first find and study the proper material.

During the year 1883 the city of Paris resolved to make some experiments, and the Director of Municipal Affairs commissioned Mr. Andre, director of the Neuilly works, to submit to him a plan for a structure that could be easily taken apart. The plan finally proposed seemed to meet all the requirements of the case, and a group of ten structures was erected. The trial that was made of these proved entirely satisfactory. The city then made concession to the Neuilly company, for six years, of the market in Boulevard Richard-Lenoir, of those of La Reine Park, and of the Madeleine flower markets. A six months' trial has shown the great resistance of the materials that we are about to describe in detail.

The structure is supported by cylindrical hollow iron uprights that are firmly connected with the ground as follows: At the places where they are to be fixed, small catches are inserted in the ground so that their upper surface comes flush therewith. These catches consist of two cast iron sides bolted together, and of a bottom and ends formed of flat iron—the end pieces being bent so as to form cramp irons. Each of the sides is provided internally with a projecting piece, and an inclined plane as a wedge. In case the catch becomes filled with dirt, it can be easily cleaned out with a scraper. The iron upright terminates in a malleable cast iron shoe, which is screwed on to it, and which is provided beneath with a projection in the form of a reversed T, the upper part of the horizontal branches of which is beveled off in a direction opposite that of the inclined planes of the catch. This projection enters through the slit and fits into the two wedges, and a simple blow of a hammer suffices to make the adherence perfect.

The front and hind uprights differ only in length, and the roof timbers are joined at their upper extremities. The figures so well show how the parts are fitted together as to render an explanation unnecessary.

The dimensions of these structures vary from 6·5 to 5·75 feet in length by 6·5 in width and 6 in height. The rafters are prolonged so as to project 4·25 feet in front, in order to form a protection for the purchaser. This part of the rafters, as well as the longitudinals, is supported by three curved iron braces, which are put in place as follows: The timbers are provided with a ring fixed by a screw, and one extremity of the brace is inserted into this, while the other is held against the upright by a sliding iron socket. The longitudinal timbers are supported between each two uprights by an iron rod that rests upon a block of stone fixed in the ground.

The front ends of the rafters are connected by a longitudinal, 18 feet in length.

The structure is covered with waterproof canvas held in place by wooden rods, to which it is attached.

The wood employed is pitch pine.

An entire market of 300 stalls can be put up in three hours by one workman and four assistants.—*Le Genie Civil.*

Fig. 1.

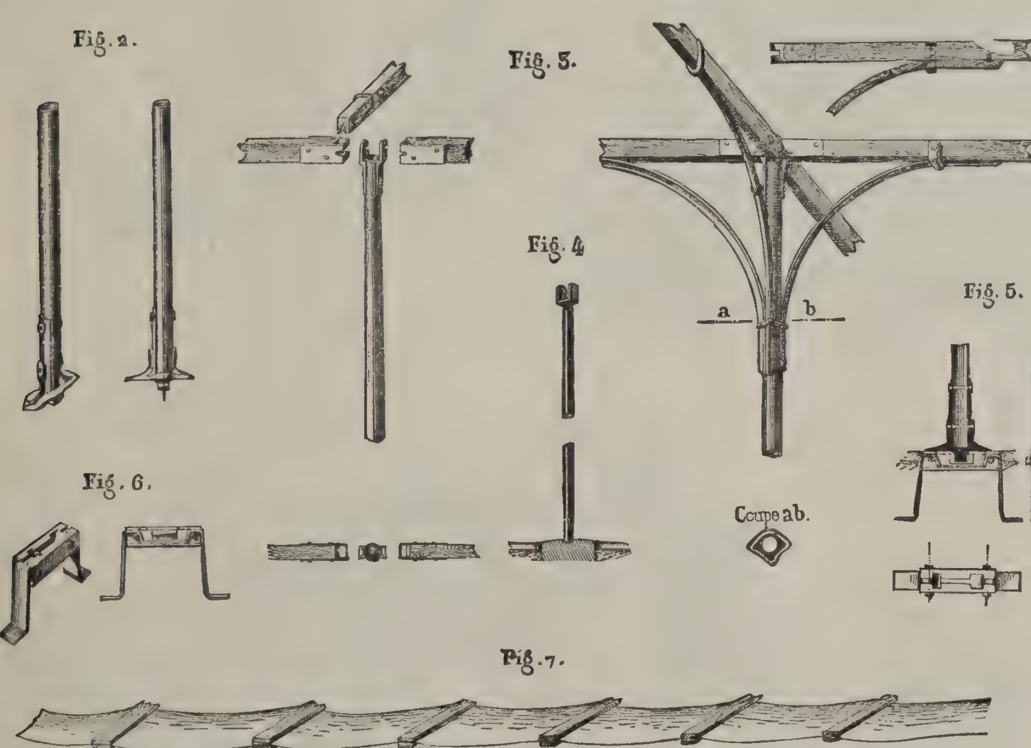


Fig. 1.—General View of a Movable Market. Fig. 2.—Shoes. Fig. 3.—Mode of Joining the Roof Timbers. Fig. 4.—Iron Support. Fig. 5.—Section of a Shoe Inserted in the Catch. Fig. 6.—Catches. Fig. 7.—Waterproof Canvas.

THE MOVABLE MADELEINE FLOWER MARKET AT PARIS.

ONE of the latest additions to articles in which paper pulp is now used is the following: A man out in Texas has corset making down to a pretty fine point. He proposes to make them of paper pulp by applying it directly to the form. By this method he is sure to get a perfect fit, and produce a corset that will outwear anything now in the market.

FINE BUILDINGS OF PROMINENCE IN NEW YORK CITY.

If, as it has been said, the progress of a nation is written in its architecture, most assuredly a glance around our own city will show a degree of progress within the last five years unrivaled by almost any city in the world; a view, then, of some of its structures will not be uninteresting to our readers. It will also reveal several facts in regard to the increasing value of real estate, and a corresponding change in the methods of erection.

To the outsider, who should visit our city to-day after an absence of five years, the tremendous size and height of many recent buildings would be a surprise; and a ride on the elevated railroad from the Battery to 159th Street, on the west side, would convince him of the truth of our first statement in regard to the progress and, we may say also, the prosperity of the city.

In the vicinity of Central Park, and most beautifully situated, are two buildings that from their excessive size and height force themselves upon the view from almost any point north of 59th Street. The style of the two buildings is in marked contrast, and forms an interesting study of that comparatively new class of building with us, the apartment flats.

The Dakota flats, 8th Avenue between 72d and 73d Streets, from the hand of Mr. Hardenberg, is a large nine story building, in buff brick, with quoins, jambs, bays, and cornices in Ohio stone, the details being in the style of the Renaissance, and in plan consisting of a large central court with its surrounding buildings, the rooms being on a magnificent scale, and most sumptuously furnished.

Each elevation shows three distinct features, the central one on 8th Avenue covered by a hipped roof, and that on 72d Street by a gable, while the two flanking portions are also in each case covered by gables; and each in turn is connected by an arched balcony, most happily designed. Above the second story is an ornamental band with moulded belt course above, whose beauty, however, it must be said, is marred by being continually broken into by the arches of the windows. Above the sixth story is the cornice, in design of

COSTLY BUILDINGS OF PROMINENCE IN NEW YORK CITY.

the Chateau de Blois order, while above is the steep roof broken by numerous dormers and bay turrets. The entrance is on 72d Street, and although it runs through the two lower stories, and is profusely ornamented, from a critical point of view its two arches interfere with each other, and detract in some degree from the dignity of a feature which so massive a building seems to demand.

It is an axiom as old as the Greeks, that the true test of a building is to strip it of its ornamentation, and mark the result of its mass. In this case most certainly the result would not be disappointing, for the several parts are simple in mass, possessed of a quiet dignity, and the disposition of the roofs well composed. We cannot help feeling, however, that the color of the material detracts from this dignity in no small degree.

This feeling is strengthened, too, as we walk down 8th Avenue, and approach the large group of buildings known as the Navarro flats, between 58th and 59th Streets and 7th Avenue, composed of red brick and trimmed with brown stone. The buildings are eight in number, are known as the Madrid, Cordova, Grenada, Valencia, Lisbon, Barcelona, Saragossa, and Tolosa, occupy a plot of 201 by 425 feet, and are the work of Messrs. Hubert & Piersson. As will be surmised from their names, the buildings are in the Moorish style of architecture, and are by far the most important of their class in the city.

In plan they consist also of large central courts, which in this case are to be turned into gardens for the exclusive use of the occupants. By a duplex system of floors some of the flats are in two stories; all the rooms are open to the exterior light and air, are large and numerous, and furnished with every possible luxury. A most pleasing and effective feature is the arched balconies on the third, fifth, and seventh stories, which, although they connect the buildings, yet leave them open on the side to light and air, besides giving them a spacious covered balcony, which we venture to predict will be a most welcome retreat in summer. From an exterior view, the corners are flanked by circular oriels, running from the pavement to the roof, a height of nine stories.

The first and second stories in each building are in rock face stone, with thin, alternate tooled bands of the same material, a treatment that is most beautiful in effect; but it is extremely doubtful if the change in the color of the stone in each building does not detract from the general appearance. Above the second story to the cornice is brick work, relieved by diaper work, and the whole surmounted by a low roof, very much broken up, and the most unsatisfactory part of the whole work. The glory of the Dakota is most certainly the faulty feature in the Navarro.

The effect of the buildings will be best seen by standing at as great a distance as possible, and noting the very picturesque sky lines, which are emphasized by the chimneys and oriels with good effect.

The two central buildings on 58th and 59th Streets, when completed, will form by far the finest group on either street, being most simple in form and detail, consisting of two simple and graceful columnated entrances, four flanking bays in iron work of Moorish design, and the central portions broken at regular intervals by window openings, giving an effect most quiet and restful. These buildings form a most interesting group, and their location cannot be excelled in the city of New York.

In the center of the activity of 23d Street is the little building known as the Eden Musee, in the style of the French Renaissance, that has attracted considerable attention during its erection. It is from the pencil of Mr. Fernbach, who, however, did not live to see it completed, and it is one of the very few building of its style in New York, although common to almost every avenue in Paris. It is but two stories with attic in the steep roof, and consists of five sections, divided by pilasters on the first story, small caryatides on the second story, and is rather overloaded with detail and ornamentation. Over the central bay is a polished Tennessee marble slab with the name in gilt, and capped by a curved pediment, while the two side sections have three small windows over the entrances and a pediment dormer above. A rather slight bronze grill ornaments the central section on the first story, and it is supposable that the doors are at present temporary only, as they do not in any way harmonize with the building; rather detract from the general appearance by their cheapness.

Another jaunt toward the Battery brings us to the busiest portion of the city, where we find a magnificent structure on Nassau Street now nearly completed, and the property of the Mutual Life Insurance Co. Mr. Clinton has here given New York a notable and worthy building, but has worked under the embarrassing condition of narrow and cramped streets, so that much of its beauty is lost to the eye. The building takes in the whole square upon which the old post office stood, and the facade on Nassau Street is divided into three distinct bays, the central one breaking back a couple of feet, and occupied in part by the entrance porch. The first story and a half are built up with granite piers slightly rusticated, and gives an appearance of strength and solidity to the whole structure. Above, a light sandstone is used, and the second order is formed by square pilasters of small height in proportion to their width, which support a cornice breaking around the whole building. Above this cornice starts the happiest feature of the building, consisting of simple flat pilasters with carved capitals and arched heads, inclosing four stories in height.

Still above the main cornice is another story, with ornamented balustrade above, but entirely lost to view, owing to the tremendous height and the narrowness of the street. Perhaps the finest feature is the porch, running two stories in height, and consisting on the first story of square pilasters covered with Renaissance carving, and flanked by a column in alternate courses of polished and fluted granite. Above are still other square shafts, with two polished granite columns. It is perhaps the most magnificent porch in the city. Mr. Clinton has been criticised as building an architectural folly, because of the relation of the new building to its surroundings. But this is evidently unfair, since, were any such rule followed out, our architecture would become a mere adaptation of a building to its surrounding buildings, be they high or low, good, bad, or indifferent, instead of standing on its own merit as an architectural work; and we may thank the architect in the present instance for ignoring just such absurd criticism, and placing on his site a building that stands head and shoulders above its neighbors in reality as well as in architectural worth. The drawing which we have made of the building is taken from a lithograph published by Root & Tinker, of this city.

Battery Park has long been regarded as a most desirable location for a building of large proportions, and Mr. Post has recently placed upon one of its most important sites the building known as the Produce Exchange, a large building covering a whole square, and in brick and terra cotta. Unlike many of our large structures it is very simple in design, and a repetition of a single well designed feature. The first story is broken by massive brick piers, inclosing an iron framed window of ornamented mullions and transoms, and supporting a heavy frieze and cornice, upon which starts the second order of pilasters of brick, with noble round arches of brick and terra cotta, the spandrels being filled with ornamented terra cotta panels, from which spring the heads of different animals in strong relief. Above these, inclosed between the frieze necking and the main cornice, is a row of nearly square windows, while above is an added story of arched windows, but giving one the impression of an afterthought or an addition. In the center of the facades are the triple entrances, with polished marble columns projecting from the face of the building, and backed by massive arches. The huge tower is unseen from Broadway, but it forms a conspicuous landmark to the south, and can be seen far away at sea.

As an example of the recent domestic architecture of our city, perhaps no buildings have attracted such general attention as the Vanderbilt mansions on Fifth Avenue. By far the finest of them is the studied work of Mr. Hunt, on the corner of 52d Street, and reminding one strongly of the old French chateaux in the department of Indre-et-Loire. Could it have been surrounded by trees, away from the whirl of Fifth Avenue, and its area filled with water, after the fashion of a moat, we should verily have had a small Chambord, a Chenonceaux, or an Azay le-Rideau. The arched entrance is broad, highly ornamented, and surrounded by a balcony whose sides are enriched by most delicate carving. Above is a beautifully proportioned triple window, over which runs the cornice with its hipped roof and dormer. In the angle of the entrance is quartered a small circular stairway, with profuse exterior ornamentation, and capped by a veritable "extinguisher top" roof.

Best of all is the extreme simplicity of the main double windows, repeated in the three stories of the main building, and ending in a dormer of exquisite design. On the side are three bays, one a hanging oriel window, supported upon an enriched and moulded corbel, while the bay itself is broken by a triple window with carved pilasters and delicate carved panels above and below. Above the bays are two more large dormers of somewhat similar design as on the front. A noticeable feature in Mr. Hunt's design is the large amount of honest, unbroken wall surface, which gives the building breadth and character, notwithstanding the unusual amount of enrichment, and this fact is the more marked because of the almost universal mania of architects to break up every surface by unmeaning panels or windows.

The buildings of which we have thus made slight mention are but a half dozen of the hundreds that are springing up all over New York that are beautifying our streets, and bidding fair to make the city the architectural center of the country.

To Advertisers.

All cuts and copy for advertisements for the December number of this paper should reach the SCIENTIFIC AMERICAN office, 361 Broadway, New York, on or before November 27.

MACHINES FOR PUTTING DOWN DRILLED WELLS.

The great economy with which an abundant supply of pure water can be obtained in almost every locality from a drilled well, has made this method of obtaining a water supply extremely popular within the past few years. Such wells are vastly cheaper than the old form of open, dug wells, and they can be put down so as to draw water exclusively from any desired stratum of rock below, without the supply being contaminated by the impurities of surface drainage. A compact and efficient machine for putting down these wells is made by the Keystone Driller Company, of Fallston, Pa., whose advertisement will be found in another part of this issue. With one of these machines an enterprising man can take contracts to put down wells through quite a large section of country, and do the work quickly, at a low cost to the customer and with a good profit.

MINERAL WOOL.

The remarkable qualities of this fibrous substance as a non-conductor of heat have had the strong indorsement of engineers, of this country and abroad, for some years. In a paper read before the American Society of Mechanical Engineers, in 1881, Mr. Charles E. Emery showed that its non-conducting qualities were far superior to those of an air space, or of any of the materials heretofore used for this purpose. Since that time the manufacture of mineral wool has been greatly improved. The United States Mineral Wool Co., of New York, make two kinds, one that is called slag wool being used for insulating, deadening, and fire-proofing, the walls and floors of buildings, etc., while their rock wool is more especially adapted for use on steam and water pipes, to prevent condensation and freezing. An advertisement of the company will be found on another page.

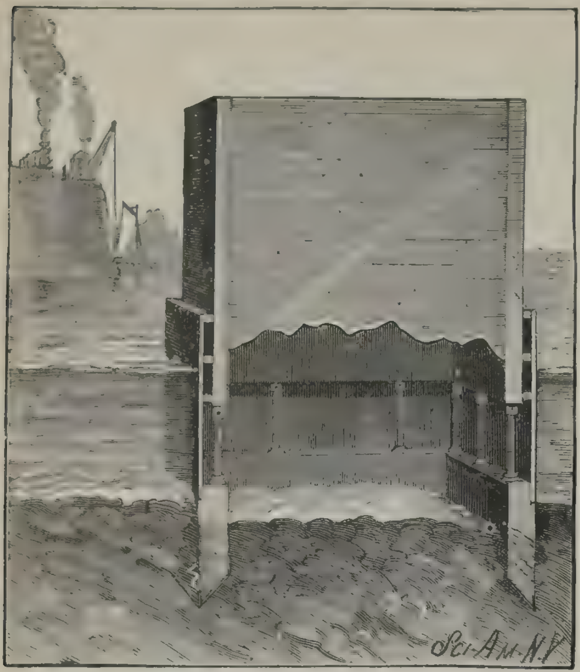
Lime and Clinker Bricks.

A further communication upon the utilization of clinkers has appeared in the *Genie Civil.* M. Gouvy has described the treatment of clinkers in a factory in Meurthe-et-Moselle, where this economy appears to have been highly developed. Here the clinkers from all the furnaces of the establishment are passed through a revolving screen, which separates them into dust, nuts, and large pieces. The dust is used in brick making, and the nuts are washed, in order to recover the small pieces of coke mixed with them. The coke saved in this way is equivalent to from 4 to 5 per cent. of the total consumption of coal in the furnaces. The dust already mentioned is ground up in a mortar mill with slaked lime, in the proportion of 10 to 3, and the mixture is pressed into bricks by a machine. These bricks are merely air dried, and are capable of being used for partition walls or paneling, or in any position in which they are not subject to heavy loads. About 2,500 bricks are made from a cubic meter of lime, and the cost of the bricks (not counting the clinker dust as of any value) is about 11 d. per 100. The bricks gain strength with age, and should be made six or seven months before use. A great proportion of the works buildings has been constructed of this material.

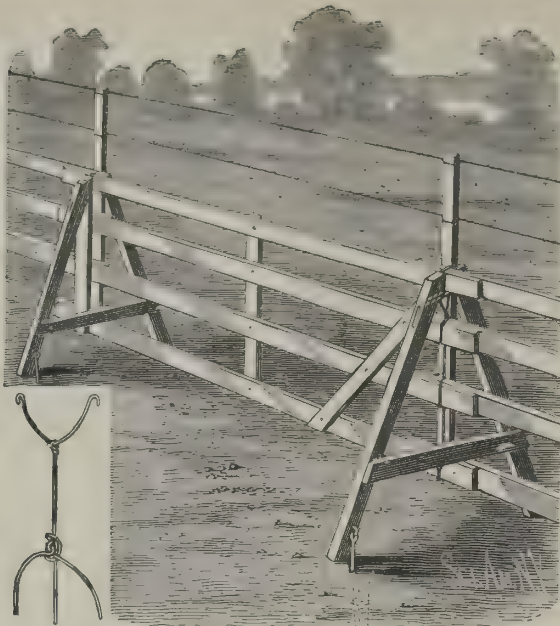
The machine used to compress the bricks is a specially designed apparatus, consisting simply of a brick mould for the mixture, placed in a frame under a monkey weighing about 200 pounds, which, like that of a pile driver, can be raised to the top of the frame and dropped upon the mould. A belt and pulley give continuous revolution to a shaft across the top of the frame, which carries a drum; and the money is raised simply by the workman holding on the fall of a rope which is made fast to the monkey and passes over the drum. By this means the moulder can graduate the force of the compressing blows of the monkey upon the mould by loosing the rope at any desired height. The block, after having been moulded, is removed by a foot lever raising it out of the mould. A man and a boy are sufficient to attend to the machine. The pale gray color of these lime and clinker bricks is admired as a relief to the ordinary red clay bricks made in the same district.

Spontaneous Combustion.

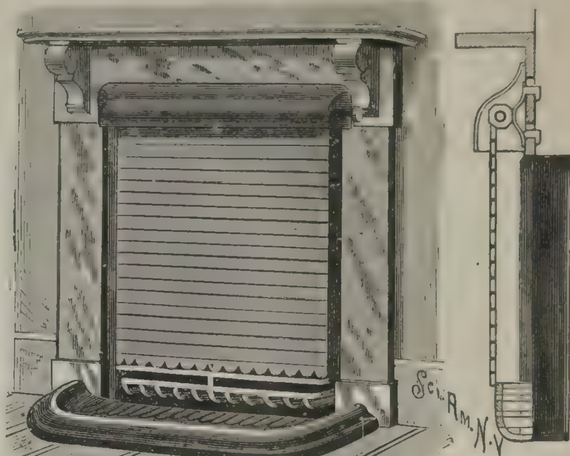
Mr. C. C. Hine, editor of the *Monitor*, relates the following: "The Institute of Technology, at Boston, long ago decided upon the danger of steam pipes passing through and in contact with wood. It was shown that the wood, by being constantly heated, assumes the condition, to a greater or less degree, of fine charcoal, a condition highly favorable to spontaneous combustion. Steam was generated in an ordinary boiler, and was conveyed therefrom in pipes which passed through a furnace, and thence into retorts for the purpose of distilling petroleum. Here the pipes formed extensive coils, and then passed out, terminating at a valve outside the building. To prevent the steam when blown off from disintegrating the mortar in an opposite wall, some boards were set up to receive the force of the discharge, and as often as the superheated steam was blown, the boards were set on fire."



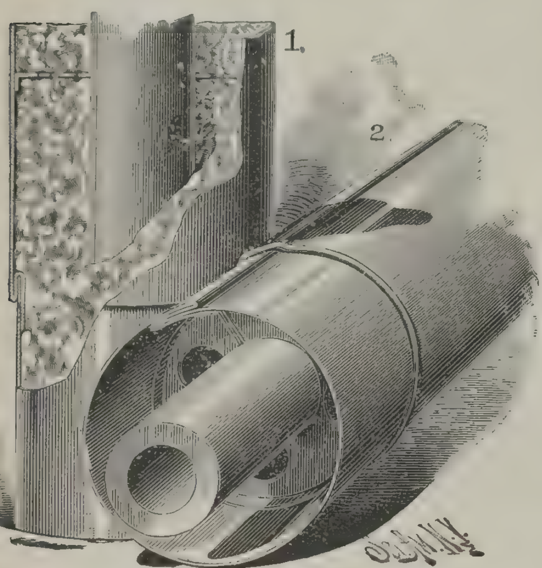
McGOVERN'S IMPROVED CAISSON



READ'S IMPROVED FENCE.

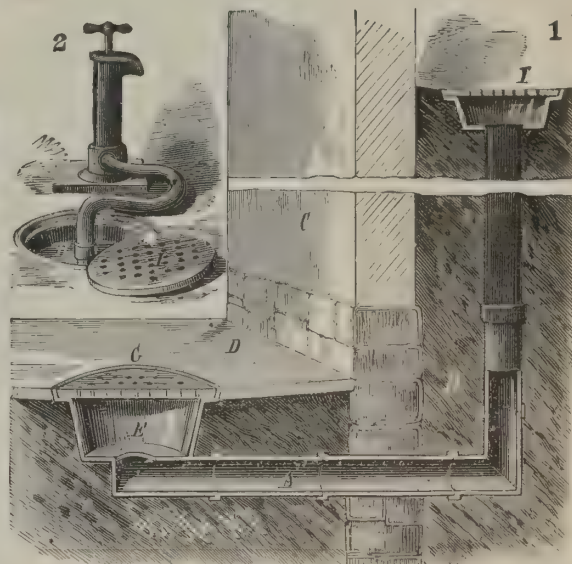


DICKINSON'S FIREPLACE ATTACHMENT.

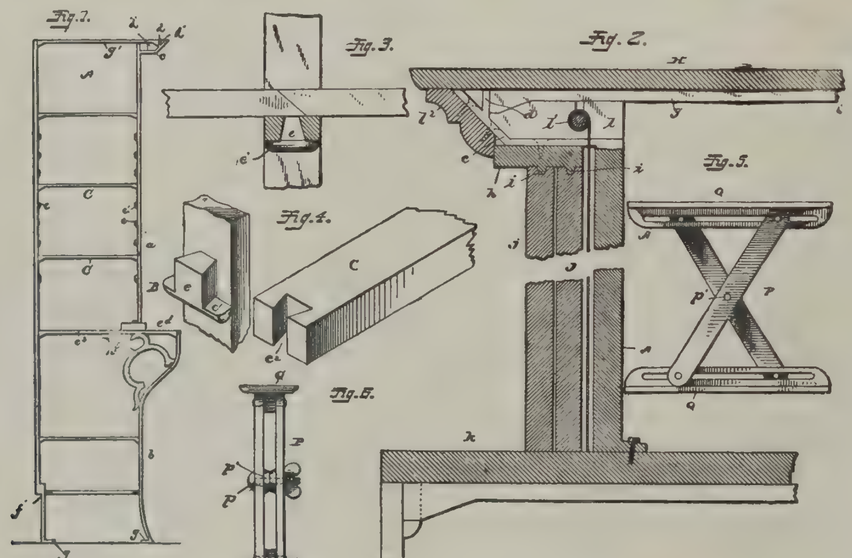


WOOD'S CASING FOR PIPES.

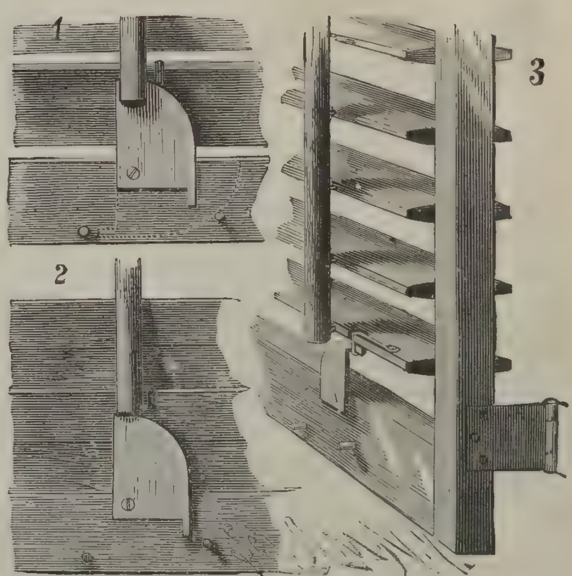
HENRY'S WINDOW SASH AND FRAME.



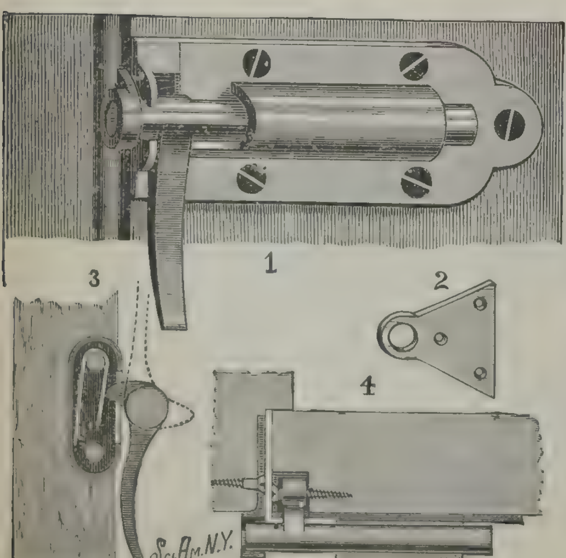
POSZ'S CELLAR DRAIN AND VENTILATOR.



REISENER'S IMPROVED SHELVING



RACEY'S CHECK FOR BLIND SLATS.



TAYLOR'S IMPROVED DOOR BOLT.

MULLEN'S SHADE ROLLER HANGER.

FURLONG'S IMPROVED LADDER

ILLUSTRATIONS OF RECENTLY PATENTED NEW INVENTIONS.—[See next page for description.]

CASING FOR PIPES.

This is a casing for holding non-conducting material—such as mineral wool, etc.—on pipes, and which can be easily applied and fitted, and closed and locked without requiring the use of solder. A disk formed with a central opening to receive the pipe is of such size as to fit within the casing. It is cut open to permit placing it on any desired part of the pipe, and has its outer edge bent down to form a flange. A series of apertures is punched in the disk, to allow the non-conducting material in the different compartments to unite by the fibers passing through. A sheet of metal from which a tube section is made has one edge creased to form a longitudinal pocket for receiving the other edge of the plate; the pocket is formed a short distance from the edge, so that when the free edge is in the pocket the edges will overlap. The joint is shown very clearly in Fig. 2. The edges of the casing sections are overlapped, and then held together by pins or nails passed through holes. The sections can thus be opened very easily to pass them around the pipe and to put in the filling material. One end edge of each section is creased to form an annular pocket to receive the adjoining edge of the next section, as shown in Fig. 1. When a pipe is to be covered, a series of disks is placed around it, a casing section is put on and secured with the pins or nails. When filled with the non-conducting material, another section is placed adjoining it.

Address the patentees, James F. and John F. Wood, of Wilmington, Del.

WINDOW SASH AND FRAME.

An invention lately patented by Mr. George W. Henry, of 195 Broadway, New York city, consists of a window frame and sash, so constructed with inclined or wedge-shaped surfaces as to make perfectly air-tight joints at all points between the frame and sash when the latter is closed. Fig. 1 is a sectional elevation of half the window, Fig. 2 is a perspective view, and Fig. 3 is a transverse sectional elevation. The lower strip of the upper sash is thicker horizontally than the upper one, and the side strips are inclined at their outer surfaces, being thickest at their bottoms, as shown in Fig. 3. The edges of the side strips are also inclined, as indicated by the dotted line in Fig. 1. The sash is thus formed with inclined surfaces in all directions, front, back, and edgewise. The lower sash is made in the same way, and the two sashes are placed in the frame with their widest parts at the center. The upper and lower portions of the frame are so formed that when the sashes are closed there will be a wedge fit at all points, whereby all dust, snow, and water will be excluded, and there will be no rattling of the sash. This invention may also be applied to solid sliding hatchways or doors, and to other frames placed in openings and adapted to slide.

REISENER'S IMPROVED SHELVING.

The shelving shown in the accompanying drawings is simple in construction, and may be readily put together or taken apart when so desired. Fig. 1 is an end view of one of the supporting frames detached; Fig. 2 is a vertical section of a completed shelf; Fig. 3 is a detail view showing the shelves overlapped; Fig. 4 shows the bars for supporting the shelves; Fig. 5 is a detail view, and Fig. 6 a vertical section, of a supplemental supporting standard. The front standard, B, of the supporting frames is cast in two pieces, *a a'*. The ends of the crossbars, C, are formed with dovetailed slots which fit upon dovetailed flanges, *e*, on the front and rear supporting standards. The bar, e^3, is somewhat longer than the other crossbars, to form a shelf portion, e^4. The lower end of the rear standard is formed with an angular seat, *f*, in order that it may fit upon the washboard, and the lower ends of the standards are formed with feet, *g*, provided with holes, so that they may be securely attached to the floor. In the upper ends of the sliding doors, *j*, are grooves into which fit ribs on the under side of a strip of wood, *h*, secured upon the under sides of the arms, *c*; the lower ends of the doors rest upon a strip of wood, *k*, which fits upon and connects the shelves of the adjacent supporting frames. The ends of a roller, *l'*, carrying a curtain of any desired material, are mounted in blocks near the ends of the arms, *c*. The top board, H, is secured to and connects the supporting frames. The moulding, l^2, of any desired form, is attached to the outer side of the arms, *c*. By means of the crossed arms, P, and the plates, Q, shelves may be supported at any height between the supporting standards.

This shelving can be made suitable for all classes of mercantile goods, and may be provided with glass doors, as a wall case, or with curtains. The shelves can be raised or lowered to suit the goods placed upon them. The lower part may be furnished with drawers, and in such cases the lower front standard would be of a different design from that shown in the drawing. By having several sets of crossbars, shelving may be had of any desired width.

All further information regarding this shelving can be obtained from the inventor, Mr. F. O. Reisener, of West Point, Iowa.

FIREPLACE ATTACHMENT.

This attachment can be applied to the front of a fireplace, to serve as a blower to regulate the draught, and to answer the purpose of a summer front. Two brackets are held upon the mantel by hooks that enter slots made at each side of the fireplace. To a roller journaled in the brackets is secured the upper end of a screen formed of metal slats connected together by links, or hinged to each other. One end of the roller is prolonged and provided with a handle or knob, by which it may be turned, and between the handle and bracket is a polygonal wheel, which is pressed by a spring, as shown in the sectional view; the pressure of the spring keeps the roller in any position. A sheet metal cover, secured to the mantel, incloses the brackets and roller. By turning the roller the screen may be raised so as to entirely open the fireplace, or it may be lowered so as to entirely close it, when it will act as a blower or as a summer front. It may also be placed at any desired height, to regulate the draught of the chimney and to prevent smoke entering the apartment.

This invention has been patented by Mr. Thomas W. Dickinson, of Sharon, Pa.

IMPROVED CAISSON.

The object of the invention shown in the annexed cut—patented by Mr. John McGovern, of Murphysborough, Ill.—is to facilitate the work of sinking coal shafts and wells and excavating for bridge foundations in ground, such as mud or quicksand, which breaks into the excavation before it can be timbered. The lower portion of the crib or caisson is constructed of timber, and of a size internally corresponding with the finished shaft. The lower portion is beveled to a sharp edge and shod with iron, so that it will enter ground readily. The upper portion of the caisson, formed of boiler iron, is bolted to the outside of the lower part, and is long enough to extend some distance upward outside the permanent timbering of the shaft, so as to prevent earth from running into the excavated space at the bottom. On the inside of the upper part are ribs taking against the permanent timbering, thus insuring an equal space all around for inserting timbers. In using the caisson to sink a shaft, it is gradually forced down by jack screws, placed, as shown in the engraving, between the bottom portion and the lower course of the permanent timbers. After having been driven far enough to give space for a course of timber, the screws are removed, the material excavated enough to permit of the work, and the timbers then put in, after which the screws are again applied. The mud or sand is allowed to remain within the caisson nearly up to the top of the lower part, and only removed as necessary, so that the caisson will be held down to place.

AN IMPROVED FENCE.

The invention herewith illustrated shows a fence that is calculated to stand firmly in heavy winds, and one that can be made, set up, and removed quickly at a reasonable cost. The side braces are firmly held by stakes driven into the ground without digging, these being connected with the braces by stout galvanized wires, and the braces firmly holding uprights which press against the boards or rails of the fence. Where these opposite braces meet, they are held by a metal tie bar or rod, which also supports the top rail, and from which depend hangers supporting the lower rails. These hangers consist of strong wire bent upon itself and formed with hooks and loops, with a button over the bends where the rest is formed, and thus binding together the end portions of the rails. The uprights are also extended a sufficient distance above the top rail to afford support for one or more wires, and thus increase the height of the fence as may be desired, these wires being either barbed or plain.

This invention has been patented by Mr. John W Read. Particulars can be had from Read Bros., of West Salem, Ohio.

TAYLOR'S NEW BOLT.

This is a simple, inexpensive, and effective bolt, which, while fastening the door, will hold it closely to its casing without regard to variations in the size of the door or casing caused by changes in temperature or weather. Fig. 1 is a perspective view of the bolt, Fig. 2 is a face view of the catch, Fig. 3 is an edge view of the door with the spring case in section, and Fig. 4 is a horizontal sectional elevation of the door, jamb, and bolt. The bar fits loosely in a bearing formed on a plate secured to the face of the door, and is formed with a lever handle projecting from near its forward end, which is adapted to enter the eye of the catch.

In a box-like chamber placed at the forward end of the plate is a U-shaped spring, which presses against a cam or eccentric lug fixed to the bolt bar about at a right angle with its handle, as shown in Fig. 3. After the end of the bar has entered the eye of the catch, the pressure of this spring against the end or toe of the lug will force the door closely against the casing; the bolt bar is locked in position by the contact point of the lug passing beyond a line through the center of the bar. The spring yields more or less to the pressure of the lug should the wood of the door or casing shrink or swell, and hence the door will always be closed tightly. To unbolt the door, it is only necessary to swing the handle so as to withdraw the lug from the spring chamber, when the bar may be moved back. To better resist the strain, the catch plate is made of a dovetail shape, and is let into the side of the rabbet of the casing. Applicable to doors, sash, blinds, or other objects requiring a fastening such as the bolt affords. John F. Taylor patentee, of West Park, N. Y.

CHECK FOR BLIND SLATS.

Fig. 1 is a face view showing the slats held half open, Fig. 2 shows the slats closed, and Fig. 3 shows them fully open. The slat check consists mainly of a plate of wood or metal made with one long flat edge, an opposite curved edge, and also with a projecting lip or catch, and pivoted to the rail below the end of the slat connecting bar. To the outer face of the lower slat is fixed at one end a spring wire catch, which extends toward the bar, and is bent in a loop at the free end, the loop passing through a slot in the slat.

When not in use, the plate is set with its straight edge uppermost, as shown by the dotted lines in Fig. 1, its curved edge resting against a pin set in the rail; the slats can then be moved freely. To hold the slats half open, the plate is moved to the position represented in Fig. 1, when its end will stand between the lower slat and the connecting rod, and the slats cannot be moved either way from the outside. When the slats are to be held fully open, the projecting lip of the plate is placed within the loop of the spring (Fig. 3), to lock the slats in the desired position. When the slats are to be held closed, the end of the plate is swung up under the connecting rod, as shown in Fig. 2. As will be readily understood, this check can be readily applied to either inside or outside blinds.

This invention has been patented by Mr. John Racey, of Quebec, Canada; further information can be obtained from Mr. John Williams, same address.

CELLAR DRAIN AND VENTILATOR.

The drain and ventilating pipe, A, is sunk into the ground at the outside of the cellar wall through which it is passed, and conducted beneath the cellar floor, which inclines downward from the walls to a receiving basin, E, fitted with a perforated top, G, to pass air and to prevent solid matters from entering and choking up the pipe. Any water entering the cellar by overflows within the building, or by leakage through the outer walls or through the cellar bottom, will collect in the basin and flow into the pipe, from where it may be pumped through a hose introduced into the head of the pipe at the outside, the cover, I, having been removed from the basin, H. As a material of which to construct the pipe, earthen tile is to be preferred, because of its cheapness and suitability.

There are many advantages claimed for this plan over drains connected with a system of sewers; dangerous sewer gases are prevented from entering the house; the walls of the building can be kept in a drier condition; non-liability to choking up under ordinary conditions, and especially so in times of flood, when the filth of sewers is forced back into the connected drains and cellars, to the positive injury of health; complete ventilation is also afforded. This plan will serve well where sewer systems are unknown, as on farms or in small towns and cities. This invention has been patented by Mr. Michael Posz, of Shelbyville, Ind.

SHADE ROLLER HANGER.

The hanger is pivoted to a screw, the construction of which is clearly shown in the side views. The screw is screwed into the top piece of a window frame, one hanger being placed at each end. The lower end of one hanger is formed with a squared socket, open at the top, and in the other is a circular socket, these being designed to receive the square and round pins of the ordinary spring roller. The hangers are swung toward the interior of the room, to facilitate the placing of the pins in the sockets. By means of this simple device the roller can be hung very easily and rapidly.

Further particulars regarding this invention, which has been patented by Mr. W. J. Mullen, may be obtained by addressing Mr. F. G. Gollon, 107 Walker Street, New York city.

IMPROVED LADDER.

The accompanying engraving represents an adjustable ladder patented by Mr. Robert Furlong, of Saucelito, Cal., for house or orchard use, and which is adapted to support a platform when desired. Two pairs of side bars are pivoted to each other in pairs a short distance above their centers. The bars of one pair are united by a series of cross bars, and the other bars by cross bars at the top and crossed braces and a cross bar near the lower ends. The bars are inclined toward each other from their lower to their upper ends, and are widest at the pivots. A strap joining the lower cross bars prevents the ladder from spreading, and serves to hold the sections at the desired inclination. When necessary, a platform can be placed on the upper rungs, or the ladder can be used without the platform. The ladder is strong, folds up compactly, and can be quickly placed in position.

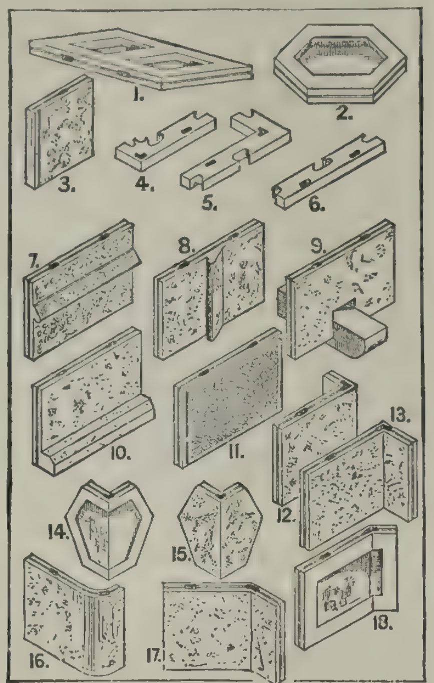
IMPROVEMENTS IN CONCRETE CONSTRUCTION.

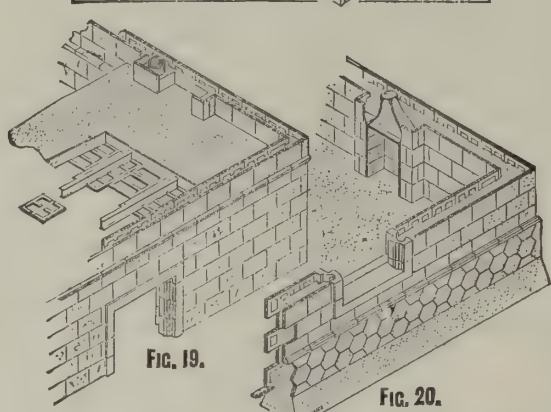
PORTLAND cement concrete if made with a non-porous aggregate is impervious to moisture, and yet at the same time, if not hydraulically compressed, will take up a sufficient quantity of moisture from the air to prevent condensation upon the surface of the walls. It not only resists the disintegrating influences of the atmosphere, but becomes even harder with the lapse of time. It may also be made in several different colors, and can be finished off to nearly a polished surface or can be left quite rough. Walls built of this material may be made so hard that a nail cannot be driven into them, or they can be made sufficiently soft to become a fixing for joinery, and, if a non-porous aggregate be used, no damp course is required. Further than this, if land be bought upon which there is sufficient gravel, or even clay that can be burnt, the greatest portion of the building material may be obtained in excavating for the cellar; and in seaside localities, if the (salt) shingle from the beach be used, sound and dry walls will be obtained. The use of concrete as a material for building will be found to meet all the defects set forth by practical people, as it may be made fire-proof, vermin-proof, and nail-proof, and in dwellings for the poor will therefore resist the destructive efforts of the "young barbarian." Nothing, therefore, can be better as a building material. The system ordinarily employed to erect structures in concrete consists of first forming casings of wood, between which the liquid concrete is deposited, and allowed to become hard, or "to set." The casings are then removed, the cavities and other imperfections are filled in, and the wall receives a thin facing of a finer concrete. If mouldings or other ornament be required, they are applied to this face by the ordinary plasterer's methods. This system finds favor in engineering construction, and also in very simple forms of architectural work, but with very complicated work the waste in casings is very great. Besides this, however, the face is found sometimes to burst off, especially if it has been applied some time after the concrete forming the body of the wall has set, and the method of applying ornament is not economical.

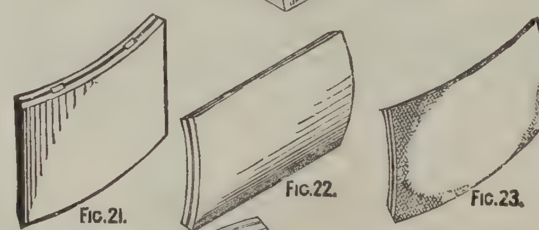
A system of building in concrete has recently been invented by Messrs. F. & J. P. West, of London, illustrations of which we now present. To this system Messrs. West have given the name of "Concrete Exstruction," from the Latin "exstructio," which they consider to be a more appropriate word than "constructio," as applied to concrete building in general. In Messrs. West's system of building in concrete, instead of employing wood casings, between which to deposit the concrete or beton, and removing them when the beton has become hard, casings of concrete itself are employed. These casings are not removed when the beton has set, but they become a part of the wall and form a face to the work. In order to form the casings, the concrete is moulded in the form of slabs. Figs. 1 to 18 of our engravings show various forms of the slab, which may be manufactured with a surface of any dimensions and of rectangular (Fig. 1), triangular, hexagonal (Figs. 2, 14, and 15), and indeed of any other form that will make a complete surface, while for thickness it may be suited to the work to which it is to be applied, that used for heavy engineering work differing from that employed in house construction. It is found that the most convenient height for the rectangular slab (Fig. 1) is 12 inches and the breadth 18 inches, as the parts of a structure built with slabs of these dimensions more often correspond with architectural measurements. The hexagonal slab (Fig. 2) is made to measure 12 inches between its parallel sides. Where combinations of these slabs will not coincide with given dimensions, portions of slabs are moulded to supply the deficiency. The moulds in which the slabs are made are simple frames with linings having a thin face of India-rubber or other suitable material, by the use of which slabs with their edges as shown, and also of the greatest accuracy, can be manufactured. That portion of the back of the slab which is undercut is formed by means of soft India-rubber cores. The moulds for making portions of the slabs have a contrivance by which their length may be adjusted to suit given dimensions.

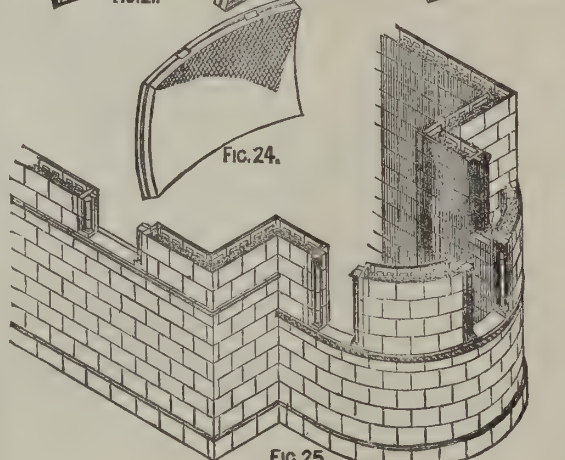
During the process of casting the slabs, and while they are in a plastic state, mouldings (if required) or other ornaments, having a suitable key, are inserted in the plastic surface, which is finished off to them (Figs. 7, 8, and 10). The slabs may also be cast with ornaments, etc., complete at one operation (Fig. 11), but it is more economical to have separate moulds for the mouldings and other ornaments, and separate moulds for the slabs, and to apply the mouldings, etc., during the process of casting the slab. Corbels (Fig. 9), sets off (which would be somewhat similar to the plinth course slab No. 10), and other constructive features may also be applied in a similar way, or may be provided for during the casting of the slab. A thin facing of marble or other ornamental solid or even plastic material may be applied to the face of the slabs during the process of casting, thus enabling the work to be finished as it is carried up, or a key may be formed on the face of the slab to enable the structure to be plastered afterward.

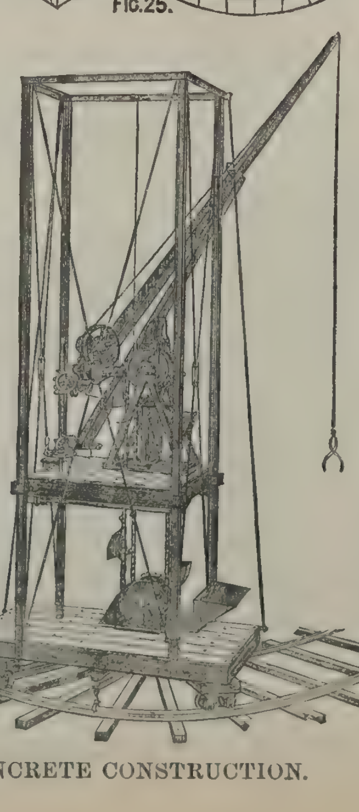
In Fig. 20, the structure from the bottom of the trenches is shown with the sides of the trenches removed. It will be seen that the footings are constructed in the most economical manner by not being stepped. As no damp-course is required in concrete work, when the aggregate is of a non-porous material, one is not shown. Upon the top of the footings is generally laid a horizontal slab, called the wall-base slab, the special feature of which is that it enables the thickness of the wall to be gauged accurately, and also provides a fixing for the first course of slabs. Figs. 4 and 5 show such slabs for internal and external angles, and Fig. 6 shows one for straight work. The use of a wall-base slab is not essential, although it is the more accurate method of building, for in cases where it is desirable to economize labor, or from other causes, the slabs forming the first course may be made with a thicker base, and may be fixed by a deposition of concrete, which is allowed to set behind them. The second course of slabs is laid upon the first course with breaking joints of half-slab bond, each course being keyed to the other by means of a quick-setting cementing material poured into the key-holes provided in the edges of the slab for that purpose, a bituminous cement being preferred. The key-holes are made in several ways, those shown in the illustrations being of a dovetail shape; circular, square, or indeed holes of any other shape formed in the edges of the slab and in an oblique direction are also employed. Special slabs for cants, or squint-quoins (Figs. 17 and 18) and angles (Figs. 12, 13, 14, 15, and 16) are manufactured, the angle occurring (if we omit the hexagonals and take the 18 inch slab) at three-quarters the length of each slab. This gives a half-slab bond to each course, as on one face of the quoin in one course will appear a quarter slab and in the course above a three-quarter slab superimposed upon it, or *vice versa*. Thus are the walls in Figs. 19 and 20 built up. For openings, the jambs and lintels (and in window-openings the sill) are made solid with a provision for a key-hole to the mass of concrete filling behind them. That portion of the jambs against which the slabs butt has a groove coinciding with a similar one in the edge of the slab, for the purpose of forming a joggle joint by squeezing the bedding material into them or by joggling them in with a cement grout. All the slabs are joggled together in a similar way.











CONCRETE CONSTRUCTION.

The plastic concrete filling or beton which the shells are made to contain may be deposited between the slabs when any number of courses (according to convenience) have been built up, and when set practically forms with the solid work introduced a monolith, to which the face slabs are securely keyed. With overclayed Portland cements, which are known to contract in setting, and with those over-limed cements which expand (both of which are not true Portland cements), the filling in is done in equal sections, with a vertical space equal to each section left between them until the first sections have become thoroughly hard, and these are then filled in at a second operation. In order to provide for flues, air-passages, and ways for electric installations, and for gas and water, pipes (made of an insulating material if required) or cores of the required shape are inserted in the plastic beton, and where necessary suitable openings are provided on the face of the work. Provision is also made for fixing joinery by inserting, where required, slabs made or partly made of a material into which nails may be driven, such as concrete made with an aggregate of burnt clay, coke, and such like. Hollow lintels are also made of the slabs keyed together at their vertical joints, and when in position these are filled in with beton. This system, however, is only recommended for fire-place openings instead of arches.

In Fig. 25, circular construction is exhibited as applied to the apsidal end of a church, slabs similar to those shown in Fig. 21 being employed for that purpose, while Figs. 22, 23, and 24 show forms of slabs suitable for constructing cylinders with horizontal axes and domes. In Fig. 19, which is the upper part of Fig. 20, is shown a system of constructing floors of these slabs. It is only necessary to explain that the slabs are first keyed to the lower flange of the iron joist by means of a cement (bituminous preferred), and the combination is then fixed in position, the edges of the slabs adhering to, or rather supported by, the iron joist being rebated so as to receive and support intervening slabs, the heading joints of which are laid to break with those of the slabs supported by the joists. For double floors the iron joists are made with a double flange on their lower edge, and are fitted to iron girders, which cross in the opposite direction. This provision secures the covering of the cross girders on their undersides by the ceiling slabs. The concrete having been deposited upon the slabs, its upper surface may be finished off in any of the usual ways, while the ceiling may be treated in any of the ways described for the walls. This system does not exclude the ordinary methods of constructing floors and roofs, although it supplies a fireproof system. Where required, bricks, stone, and, in fact, any other building material, may be used in conjunction with the slabs.

The system of building construction is intended, as in the case with all concrete, to supersede brickwork and masonry in the various uses to which they have been applied, and, at the same time, to offer a more perfect system of building in concrete. Hitherto slab concrete work has never been erected in a perfectly finished state (*i. e.*, with mouldings, etc., complete), but has either been left in a rough state or without ornament, or else has been constructed so as never to be capable of receiving good ornamental treatment. Hitherto the great difficulty in constructing concrete walls of concrete and other slabs has been to prevent the slabs from being forced outward or from toppling over by the pressure of the plastic filling-in material from the time of its deposition between the slabs until it has become hard enough to form, with the slabs, a solid wall. Besides the system of forming the slabs of L (vertical or horizontal) section, or with a kind of internal buttress and shoring them up from the outside, or of supporting the slabs upon framing fixed against the faces of the wall, several devices have been used to obviate this difficulty.

In the first place, temporary ties, or gauges, connecting the slabs forming the two faces of the wall, have been used, and as soon as the plastic filling-in material has set or become hard (but not before), these have been removed. Secondly, permanent ties or cramps have been used, and, as their name implies, have been allowed to remain in the wall and to be entirely buried in the plastic filling-in material. These permanent transverse ties or cramps have been of two kinds: those which were affixed as soon as the slabs were placed in position, and those which were made to form part of the manufactured slab, as, for instance, slabs of Z or H horizontal section. Thirdly, a small layer of the plastic filling-in material itself has been made to act as a transverse tie by depositing it, when plastic, between the slabs forming the two parallel faces of each course, allowing it (before filling in the remaining part) to set and to thus connect together the slabs forming each face of the wall, a suitable hold on the slabs, in some cases, being given to the tie by a portion of the slab being undercut in some way, as by being dovetailed, etc. As the slabs in this latter system generally have wide bases, they may also be bedded or jointed in cement, and, provided temporary ties be placed across their upper edges to connect the slabs forming each face of the wall together, the space between the faces of the wall may then be filled in with the plastic concrete.

All these devices, however, are not of permanent utility; they are only temporarily required (*i. e.*, up to the time that the beton has become hard and formed a permanent traverse tie between the two faces of the wall), for it is manifest that the ultimate object of all slab concrete construction is: (*a*) To retain and to mould the plastic concrete used in forming the wall; (*b*) to key or fix the slabs to the mass which they themselves have moulded; and (*c*) to form a facing to the wall. When these objects shall have been accomplished,

SIDE ELEVATION.

FRONT ELEVATION.

A Village Residence.

O. P. Hatfield, Architect.
31 Pine St. New York.

SCALE: 1/16 INCH = 1 FOOT.

SECOND STORY

FIRST STORY

SCALE: 1/16 INCH = 1 FOOT.

SUPPLEMENT TO THE SCIENTIFIC AMERICAN-ARCHITECTS AND BUILDERS EDITION-NOVEMBER 1885.

SCHUMACHER & ETTLINGER, NEW YORK.

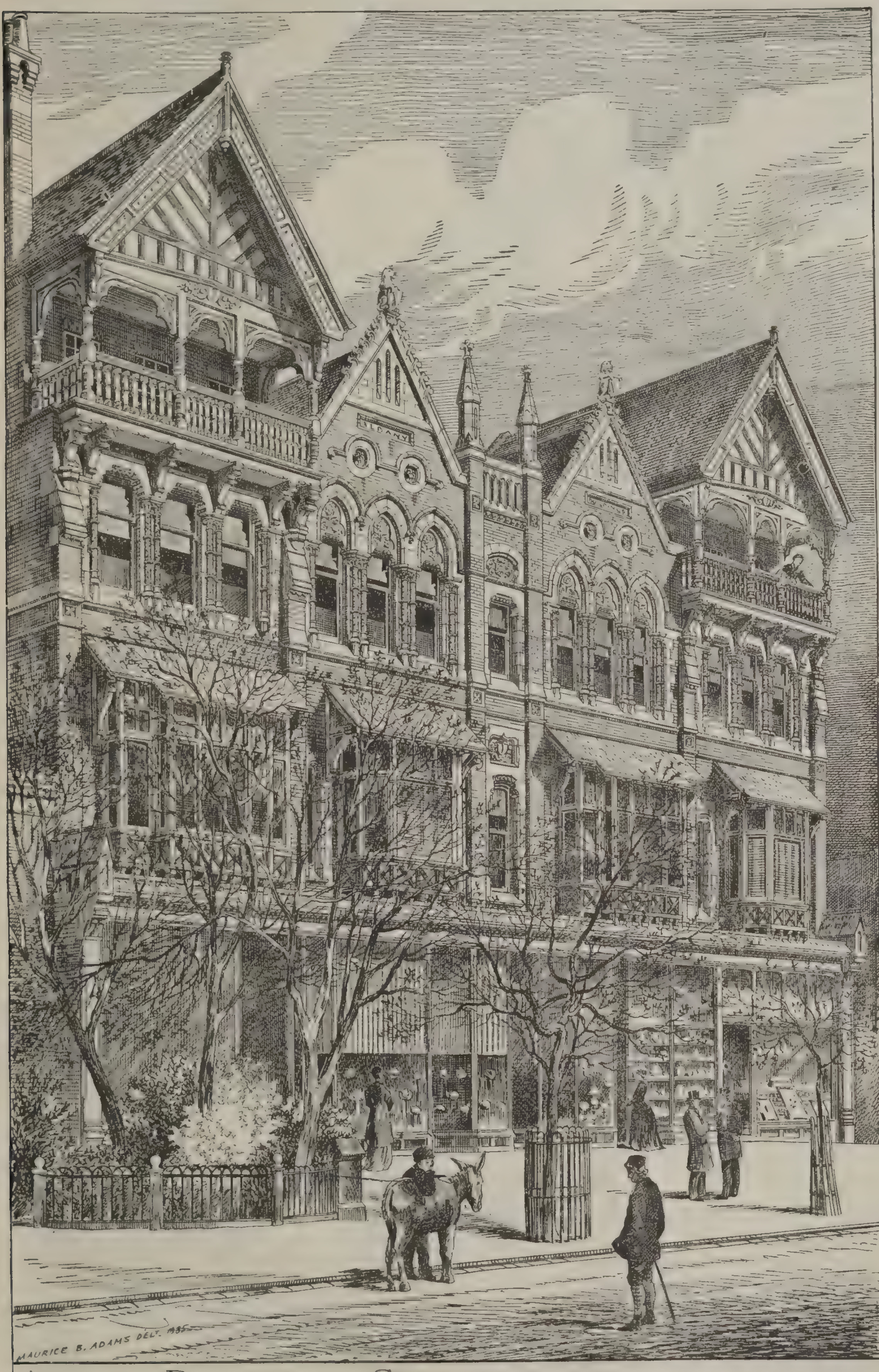
there is no further need of any tie whatever beyond that which naturally obtains in a concrete wall. In West's system, however, where the slabs are keyed course to course, any kind of transverse tie to be used during the process of construction, except that used in the starting course, is entirely dispensed with, and the courses of slabs above depend solely upon the courses of slabs below them for their stability and rigidity up to the time that the plastic filling-in has been deposited and become hard between both faces of the wall.

There is, however, a more decided difference between West's system and those previously in use, for it is marked by the fact that the slabs composing the shell of the whole structure in many cases may be built up before the filling-in is deposited between the slabs, and in none of the other cases can this be done. In fact, only in the first two cases before mentioned can more than one course of slabs be laid before filling-in of some kind must be done. Compared with the ordinary method of building in concrete, this system avoids: 1. The charge for use and waste of wood casings; 2, finishing the face of the work (both inside and outside) after the structure is raised, and, therefore, the bursting-off of the finished face; and 3, the difficulties encountered in working mouldings and other ornaments on the face of the work by the ordinary plasterer's methods. It also provides a face of any of the usual colors that may be obtained in concrete, besides a facing of any other material, such as marble, etc., and produces better and more durable work, at the same time showing a saving in cost, especially in the better classes of work; all of which is effected with less plant than ordinarily required. For engineering work, such as sea walls, the hexagonal slabs, made of greater thickness than those employed for ordinary walling, will answer admirably, especially if the grooves be made proportionately larger. By the use of these slabs the work may be built up with great rapidity. For small domestic work, such as the dwellings of artisans, these slabs, which are of such a form as to render them easy of transport, may be supplied to the workmen themselves in order that they may erect their own dwellings, as, on account of the simplicity of this system and the absence of need of plant, any intelligent mechanic can do the work.

Any arrangement of independent scaffolding may be employed for this system, but that invented specially for the purpose by Mr. Frank West, as shown in Fig. 26 of our engravings, is to be preferred. It not only supplies the necessary scaffold, but also the necessary arrangements for hoisting the slabs, as well as for raising the liquid concrete and depositing it behind the slabs. It is really an independent scaffold, and may be used wherever a light tramway of contractor's rails can be laid, which in crowded thoroughfares would of necessity be upon a staging erected over the footway. The under frame is carried upon two bogie frames running upon the contractor's rail, by which means it is enabled to turn sharp curves, a guide plate inside the inner rail being provided at the curves for this purpose. The scaffold itself consists of a climbing platform made to travel up or down by means of four posts which have racks attached to their faces, and which are fixed to the under frame and securely braced to resist racking strains. A worm gearing, actuated by a wheel on the upper side of the scaffold, causes the scaffold to ascend or descend. A railgrip, made to act at the curves as well as on the straight portions of the rail by being attached to a radial arm fixed to the under frame, assists the stability of the scaffold where required, but the gauge of the rails is altered to render the scaffold more or less stable according to its height. Combined with the same machine, and traveling up and down one of the same posts used for the scaffold, is an improved crane. Its action depends upon the proposition in geometry that if the length of the base of a triangle be altered, its angles, and therefore its altitude, are altered. A portion of the vertical post up and down which the crane climbs forms the base of a triangle, and a portion of the jib, together with the stay, forms the remaining two sides. Hence, by causing the foot of one or the other to travel upward, by means of the worm gearing, the upper end of the jib is either elevated or depressed.

The concrete elevator, which is also combined with the scaffold, consists of a series of buckets carried upon two parallel endless chains passing over two pairs of wheels. On the under frame is fixed a hopper, into which is thrown, either by hand or from a concrete mixer running upon the rails, the material to be hoisted, and from which it gravitates into a narrow channel, through which pass the buckets (attached to the chain) with a shovel-like action. The buckets, a motor being applied to one pair of wheels, thus automatically fill themselves, and on arriving at top are made to tip their contents, and jar themselves, automatically into a hopper by means of a small pinion, keyed to the shaft by which they are attached to the endless chain, becoming engaged in a small rack fixed for that purpose. From the upper hopper the material is taken away to the required destination by means of a worm working in a tube. For varying heights, extra lengths of chain and buckets are inserted and secured by a bolt passed through each end link, and secured by a nut. By using this scaffold, a saving in plant, cartage, and labor is effected. The elevator may also be used for raising any other material besides concrete.

Such is the new system of concrete construction and scaffolding of Messrs. West, which appears to be based on sound and reasonable principles, and to have been thoughtfully and carefully worked out, and which moreover gives promise of success in the future. We may add in conclusion that specimens of the work and a model of a scaffold are shown by Messrs. West at their stand in the Inventions Exhibition.—*Iron.*



ALBANY BUILDINGS SOUTHPORT E.W. JOHNSON, ARCHITECT.

THE BLUE PRINT PROCESS.

R. W. JONES.

1. COVER a flat board, the size of the drawing to be copied, with two or three thicknesses of common blanket or its equivalent.
2. Upon this place the prepared paper, sensitive side uppermost.
3. Press the tracing firmly and smoothly upon this paper, by means of a plate of clear glass, laid over both and clamped to the board.
4. Expose the whole—in a clear sunlight—from 4 to 6 minutes. In a winter's sun, from 6 to 10 minutes. In a clear sky, from 20 to 30 minutes.
5. Remove the prepared paper and pour clear water on it for one or two minutes, saturating it thoroughly, and hang up to dry.

The sensitive paper may be readily prepared, the only requisite quality in the *paper* itself being its ability to stand washing.

Cover the surface evenly with the following solution, using such a brush as is generally employed for the letter-press: 1 part soluble citrate of iron (or citrate of iron and ammonia), 1 part red prussiate of potash, and dissolve in 10 parts of water.

The solution must be kept carefully protected from light, and better results are obtained by not mixing the ingredients until immediately required. After being coated with the solution, the paper must be laid away to dry in a dark place, and must be shielded entirely from light until used. When dry, the paper is of a yellow and bronze color. After exposure the surface becomes darker, with the lines of the tracing still darker. Upon washing, the characteristic blue tint appears, with the lines of the tracing in vivid contrast. Excellent results have been obtained from glass negatives by this process.—*Proc. Eng. Club, Phila.*

REPRODUCTION OF DRAWINGS IN BLUE LINES ON WHITE GROUND.

A. H. HAIG.

THE following process for making photographic copies of drawings in blue lines on white background was invented by H. Pellet, and is based on the property of perchloride of iron of being converted into protochloride on exposure to light. Prussiate of potash when brought into contact with the perchloride of iron immediately turns the latter blue, but it does not affect the protochloride.

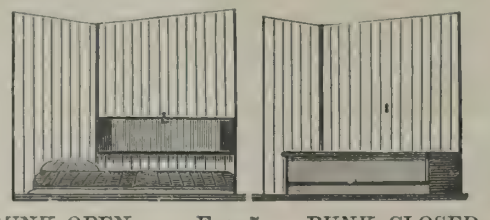
A bath is first prepared consisting of ten parts perchloride of iron, five parts oxalic or some other vegetable acid, and one hundred parts water. Should the paper to be used not be sufficiently sized, dextrine, gelatine, isinglass, or some similar substance must be added to the solution. The paper is sensitized by dipping in this solution and then dried in the dark, and may be kept for some length of time. To take a copy of a drawing made on cloth or transparent paper, it is laid on a sheet of the sensitive paper, and exposed to light in a printing frame or under a sheet of glass. The length of exposure varies with the state of the weather from 15 to 30 seconds in summer to from 40 to 70 seconds in winter, in full sunlight. In the shade, in clear weather, 2 to 6 minutes, and in cloudy weather, 15 to 40 minutes may be necessary. The printing may also be done by electric light. The print is now immersed in a bath consisting of 15 to 18 parts of prussiate of potash per 100 parts of water. Those parts protected from the light by the lines of the drawing immediately turn blue, while the rest of the paper, where the coating has been converted into protochloride by the effects of light, will remain white. Next, the image is freely washed in water, and then passed through a bath consisting of 8 to 10 parts of hydrochloric acid to 100 parts of water, for the purpose of removing protoxide of iron salt.

It is now again washed well in clean water and finally dried, when the drawing will appear in blue on a white background.—*Proc. Eng. Club, Phila.*

A COTTAGE, COSTING $150.

By S. B. REED, Architect, Corona, Long Island, N. Y.

THESE plans are for an economical cottage, for an occasional summer residence of a family of four persons. It is suited to almost any place, either by the water or on the mountain, where rest and recreation are sought. It costs scarcely more than a first-class family tent (which it is designed in a measure to supplant), and is far preferable, as it affords better protection and accommodation, and is more convenient and comfortable. It also admits of some of the home-like ways of living. Tents supply little comfort; their form necessitates a cramped, disagreeable position, with barren walls, and very small facilities for housekeeping. They sway and vibrate with every wind, and are intolerable in a storm. Out-door shade, so desirable in summer, is usually already provided by large trees. A single low tree, with extended branches, may shade several cottages, and serve as a support for swings and hammocks for the young folks. In connection with the building, stationary fixtures for bedsteads, tables, etc., arranged to fold up when not in use, save largely in room and furniture expenses. Exterior (Figs. 1 and 2).—The upright boarding and battening of the sides, the figured, gable barges, hooded projections, and steep roof, are appropriate in material and style. The building is set one foot above the ground, and the space below is inclosed by turfing around to the level of the sill. For better appearance, and to raise the floor further from the ground, an additional foot or two of elevation may be given, with increased banking or terrace. Accommodations (Fig. 6).—The interior has two rooms and two closets. The front portion, intended for the family-room, is of fair size, with two windows in each of two sides, and three doors, as shown. A folding-bed is built in one corner, and a large shelf between windows at A; sufficient room remains for a center-table, chairs, etc. The rear room, or kitchen, has two windows, an outside door, and a closet. A circular shelf and a stove are placed at the side of the closet. A bunk placed in the opposite end of the room serves as a seat during the day, and for a bed at night. A table is hung against the partition. Construction.—The foundation may be of stone, or posts set in the ground. The floor timber is framed together—leveled on the foundation, and floored over, and the edges cut even with the sills. The upright frame 1¼ x 5-inch plank, and the plates 1¼ x 6 inches, are then placed in position, with openings for doors and windows, as shown in Fig. 4. The exterior boarding, dressed on both sides, is then put on and battened. The roof is similarly boarded—with the center portion ceiled down, leaving an air space above. At the ends of this air space in each gable are openings through the siding for the passage of the heated air from under the roof. Similar openings in the ceiling over the center of each room lead into the air space. Each opening is neatly finished with lattice work. The roof projects 8 inches and has a 3-inch marginal strip all around, with pierced barges in each gable, covered with pine shingles. The door openings are protected by shingled hoods resting on dressed trusses. The windows are neatly capped. Each window has battened shutters, with wrought-iron hinges and fastenings. The inside framework (see Fig. 3) forms the jambs of the doors and sashes, to which they are hung with ordinary butts. The intervening spaces show as panels. The inside partition is 6½ feet high, and has an 8-inch cap projecting mostly to the kitchen side; this cap strengthens the partition, and forms a shelf. The outside and partition doors are paneled; the others are battened and clamped. The kitchen closet has four shelves, and the other, or front closet, has one shelf and two rows of hooks. The circular shelf at the side of the kitchen closet is set level with the bottom of the sash, and has a sheet of zinc attached to its inner edge extending to the floor, protecting the surrounding wood-work from the heat of the stove. The table is 2½ x 4 feet, is hung to the partition, and supported on swinging braces. The bed frame is constructed of ceiling boards, as shown (see Fig. 4); when opened, answers the purpose of a bedstead, and when closed serves as a closet for the bedding. The bunk (see Fig. 5) is also of ceiling boards clamped together. These devices are easily made by any carpenter, are inexpensive, and answer their purpose acceptably. The outside has two coats of paint, of any desired color, prepared and applied in the usual manner. The inside is stained with oil.



BUNK OPEN. FIG. 5. BUNK CLOSED.

FIG. 1.—FRONT.

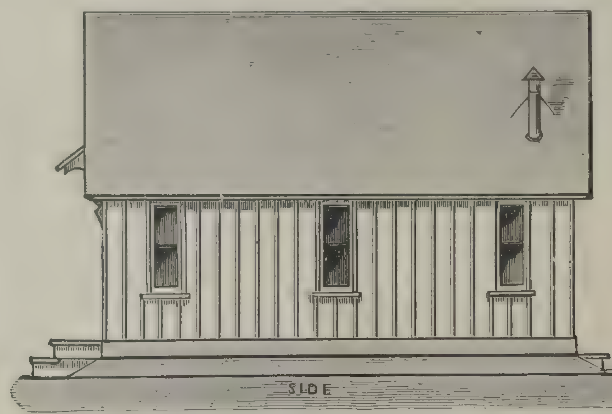


FIG. 2.—SIDE VIEW OF SUMMER COTTAGE.

FIG. 3.—INTERIOR OF FRONT.

FIG. 4.

BED CLOSED. BED OPEN.

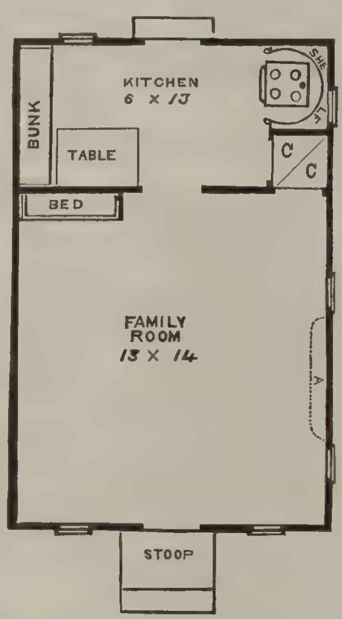


FIG. 6.—FLOOR PLAN.

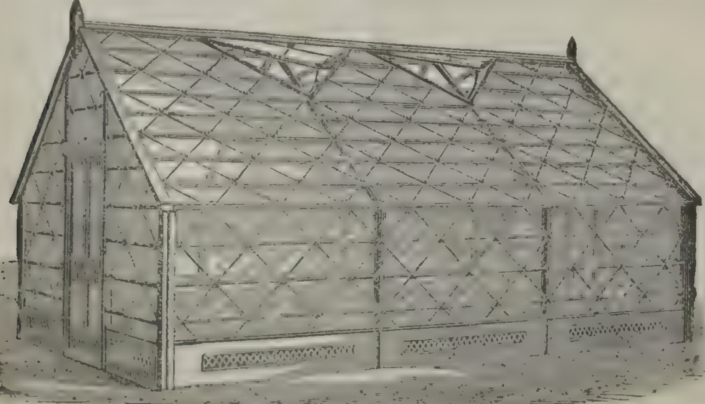
Estimate, cost of materials and labor :

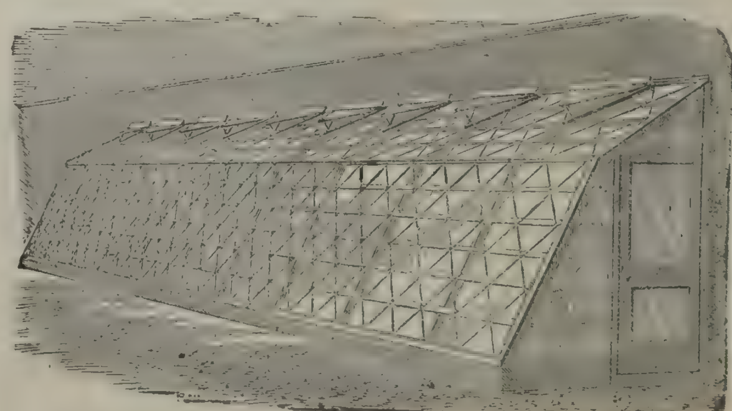
378 feet of timber, at $15 per M	$5 67
2 sills, 3 x 7 in., 20 feet long.	
11 beams, 3 x 7 in., 13 feet long.	
1 ridge, 2 x 7 in., 20 feet long.	
2 purlines, 3 x 4 in., 20 feet long.	
30 flooring boards, at 28c. each	8 40
53 ceiling boards (dressed both sides), at 28c. each	$14 84
54 ceiling boards (dressed one side), at 28c. each	15 12
53 battens (half round, 1½-inch wide), at 6c. each	3 18
10 planks, $3.50; 15 boards, at 28c. each, $4.20	7 70
14 bunches shingles, at $1.25 each	17 50
6 sashes, $6.00; 3 paneled doors, at $1.15 each	9 45
2 lengths of tile pipe, at 50c. length	1 00
Hardware, nails, and incidentals	16 14
Painting, $25.00; carting, $6.00	31 00
Carpenter's labor, not included above	20 00
Total cost, complete	$150 00

—*American Agriculturist.*

BUILDINGS IN GLASS.

GREENE & SON, of Saffron Walden, Eng., have introduced the following improvement in the method of fixing the glass of lean-to roofs or conservatories. It is a new form of metal clip to receive the corners of square panes, the panes being arranged diagonally—that is to say, with the corners at the top, bottom and sides, as seen in our illustration. The panes of glass are also arranged to overlap, the upper ones above the lower, and thus to thoroughly throw off all rain. The surface of the glass covering is thus completely flush, without sash-bars or ridges to catch the rain or dirt. The appearance of such a glass roof will therefore always be clean, with a complete glassy surface, and the diagonal arrangement will add to the picturesque effect. The metal clips are riveted direct to light iron purlines, or bent round strips of metal which may be riveted to the purlines. This metal clip is in form something like a tally, having one projecting tag at the top which forms the means of attachment, and the lower part spreads out into a triangular shape, with its upper sides cut into three strips. The center strip of these three, one on each side, is bent upward, and thus forms a rest, against which the neighboring side panes respectively rest. The two outside strips are bent downward, and under the top corner of the lowest pane of glass, which is thus firmly secured. The side panes are then placed over the lowest one to lap according to taste, till they rest securely against the middle strips of the clip, before described as being turned upward. These middle strips may then be turned down upon the two side panes—a projection upon these strips further serving to support the bottom corner of the next pane above. Each clip is thus a plain piece of metal stamped or cut to the required shape, and answers the purpose of firmly securing four corners of four different panes of glass. In the case of the bottom rows of panes, the large or square panes of the second row rest with their bottom angles in the clips, and right and left of it the panes are portions only of a similar square. In this case only three panes are in contact with each of the bottom clips. The parts of the clips which in the upper rows turn over the top angles of the lower panes are here secured to the first supports, each clip being intended to support the pane immediately above it and the side adjacent panes. In a roof of this kind there is a complete exclusion of rain and snow, as the whole roof is glass over glass—as complete as is the case in a slated roof. There is also freedom of exit for products of condensation and perfect liberty for the expansion and contraction of the glass. The arrangement of the laps insures their being washed perfectly clean by a shower, and there is also a maximum of light and absence of vertical shadows. There must be also considerable economy in cost of construction, as no after painting of sash bars and no glazier's putty-work are required. Any unskilled amateur could fix his own glass, and in cases of breakage or renewal no glazier need be called in, if a few spare panes of glass are kept on stock for such contingencies. There thus seem to be many points of improvement in the form of roof we have described, and no doubt glass construction will be much facilitated by such an invention.—*Iron.*





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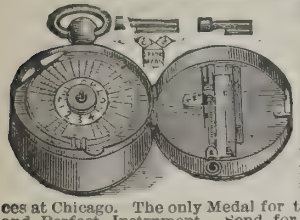

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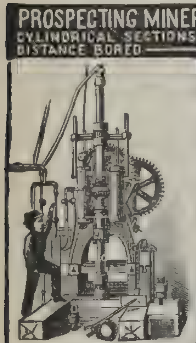

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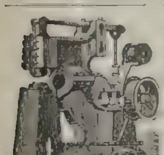

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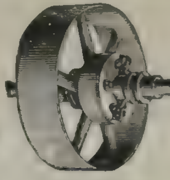

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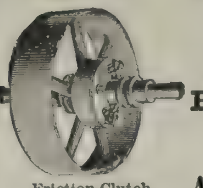

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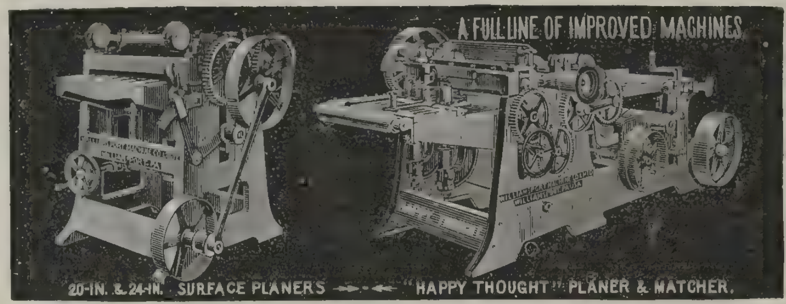

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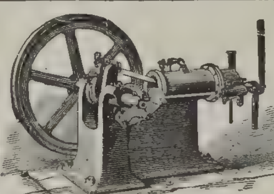

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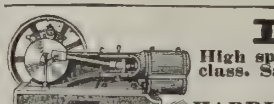

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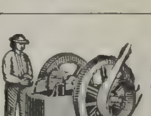

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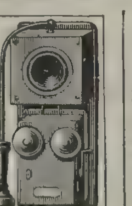

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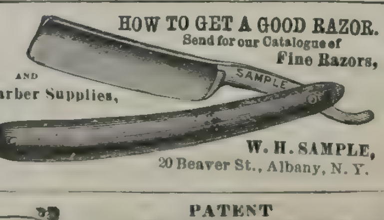

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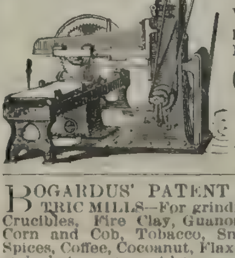

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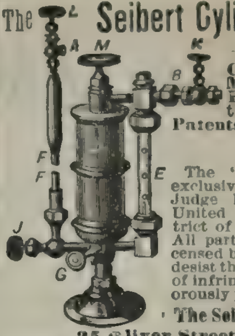

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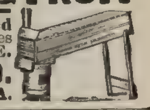

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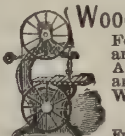

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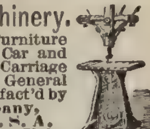

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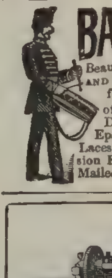

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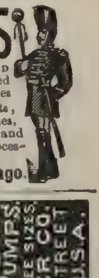

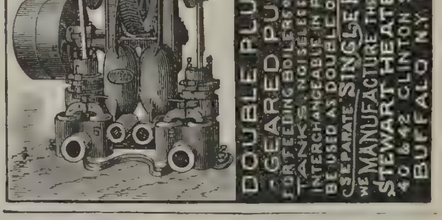

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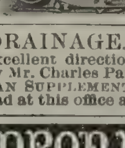

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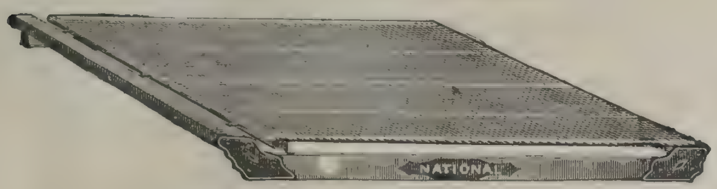

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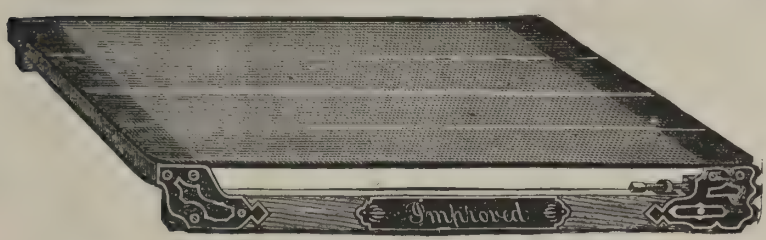

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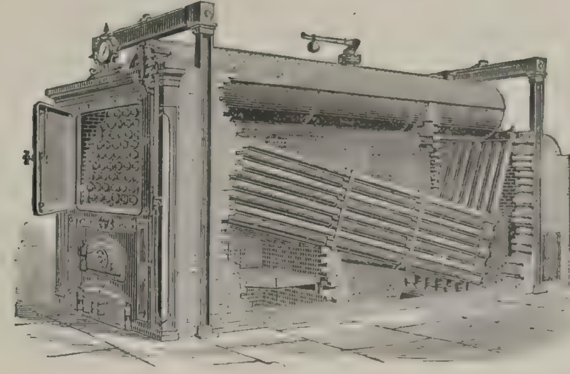

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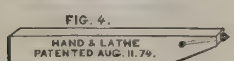


FIG. 1.

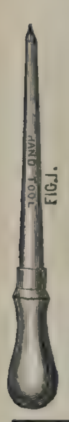
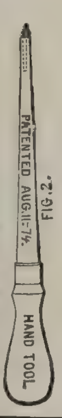


FIG. 2.



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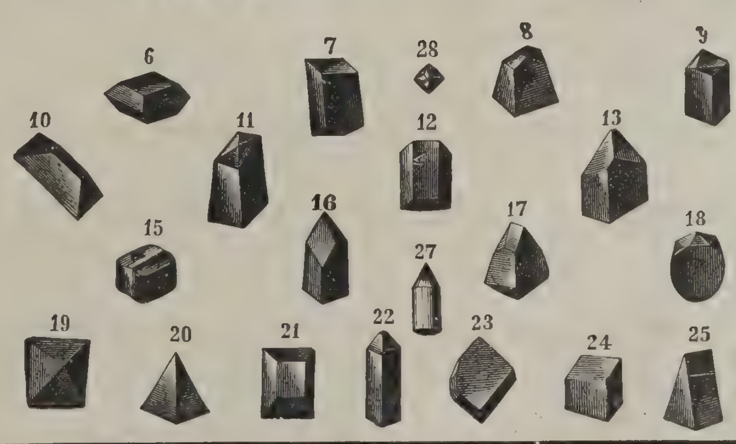

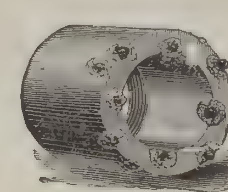

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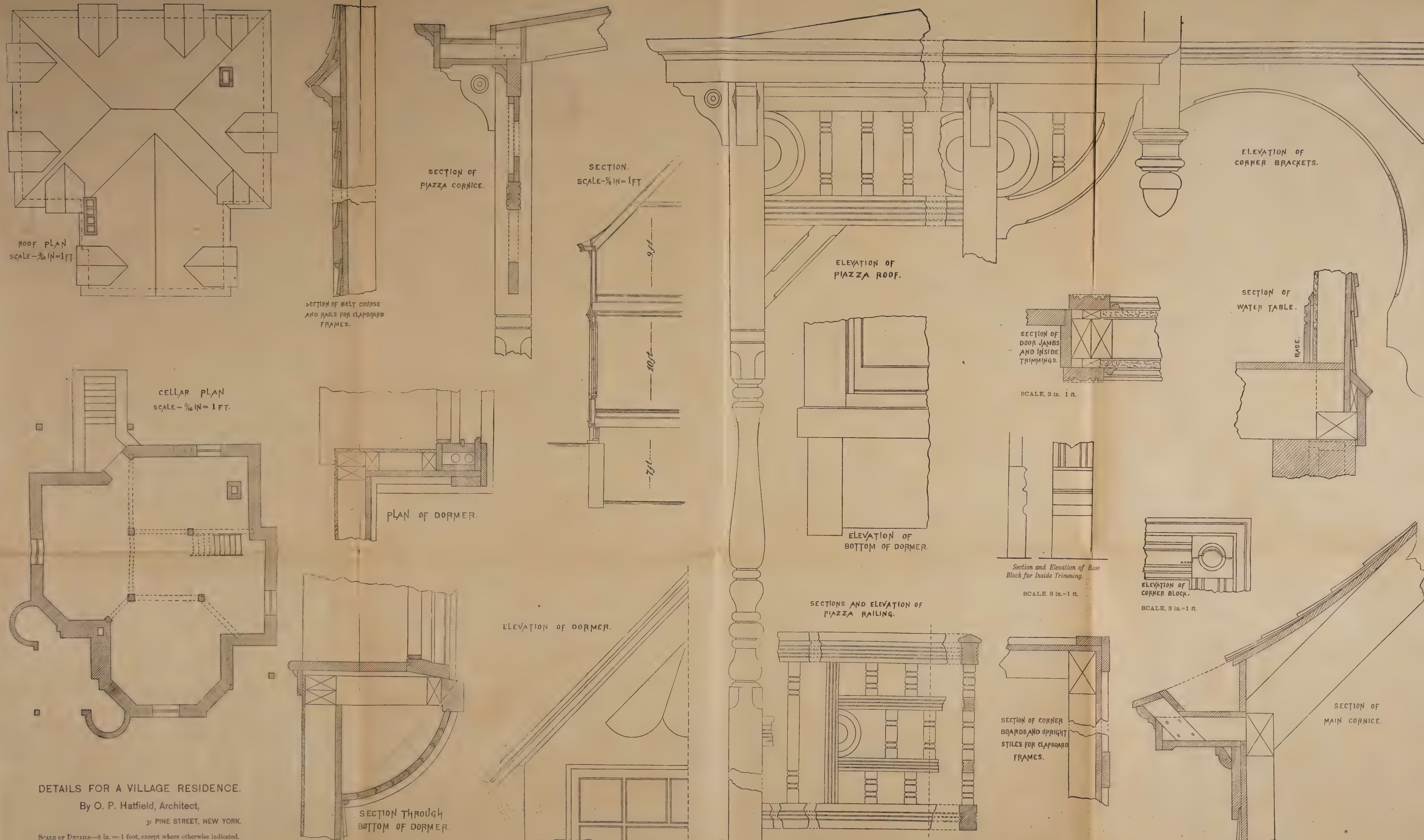
PUBLISHED IN THE PRESENT NUMBER OF THE

Scientific American, Architects and Builders Edition.



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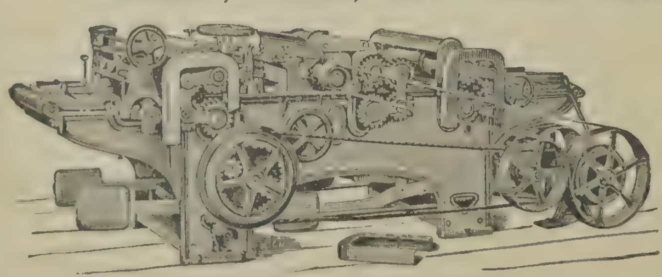

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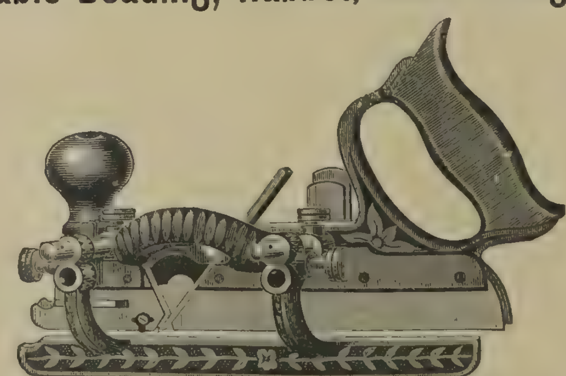

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REPAIRING THE COOPER INSTITUTE BUILDING, NEW YORK CITY.—[See page 39.]

Scientific American.

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O. D. MUNN. A. E. BEACH.

NEW YORK, DECEMBER, 1885.

THE Scientific American, ARCHITECTS AND BUILDERS EDITION.

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CONTENTS

Of the December number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

OTHER PUBLICATIONS.

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THE SCIENTIFIC AMERICAN SUPPLEMENT No. 518,

For the Week Ending December 5, 1885.

Price 10 cents. For sale at this Office and by all Newsdealers.

THE GREYHOUNDS OF THE ATLANTIC.

It is a question whether the new class of steamships of extreme speed and enormous size can be made as acceptable to their owners as to the public, for the large expense for first cost and maintenance makes it doubtful on which side the financial margin will be found. The managers of the Cunard Line seem, however, to have satisfied themselves of their profitableness, for within the past few years they have added to their fleet as many as five of the fastest and largest vessels afloat. The French Steamship Company are following the same policy, and the voyage from New York to Havre will be made next summer by the large new steamers recently built for the purpose. The other lines, however, are more conservative. The White Star Line has not added a new vessel to its fleet for years, and its steamers can no longer be called swift. The same thing holds true of the Inman Line. The America, of the National Line, and the City of Rome, of the Anchor, are both known as ocean racers. The Guion Line retains the Alaska and the Arizona, but was glad to sell the Oregon to the Cunard Company; and it is said that the rumor of war between England and Russia, which led to the chartering of this and other vessels, was hailed with delight by those companies whose property was taken. It will be observed that the evidence in the matter is decidedly ambiguous. While the one company is increasing size and speed, the others are holding back. The cost of operating these immense steamers is enormous, while the rates for ocean travel are, if anything, on the decline. The great size made necessary by high speeds adds to the resistance while it increases the power, and the greater space occupied by engines and coal bunkers does not permit a corresponding increase in the carrying capacity. The cost of a steamer like the Etruria is about $1,000,000; she burns over 300 tons of coal daily, and her crew is necessarily much larger than on a vessel of from five to six thousand tons burden.

She has carried as many as 600 first class passengers at one trip, and could this rate be maintained all the year round, she would, of course, be a very profitable investment; but the season of heavy travel is limited, and for a large part of the year she must either be laid up or run at a loss. The real question, then, as the *Tribune* puts it, is whether it will pay to build vessels at a vast cost which will run almost empty during half the year, and will make the passage from New York to Queenstown in twenty-fours less time than other vessels which cost much less and burn half as much coal. In the long run, it will probably be found that the most profitable steamers for transatlantic passenger service are boats like the Britannic, the Gallia, and the Normandie, which cross in about eight days. They burn something less than 200 tons of coal a day, and can accommodate about 300 passengers. The gain of the larger and swifter boats in capacity and speed is at too great a cost.

M. PASTEUR'S RESEARCHES IN THE TREATMENT OF HYDROPHOBIA.

The entire civilized world has for some time past been watching with intense interest the experiments on the treatment of hydrophobia conducted by the celebrated French scientist, Dr. Louis Pasteur. These researches have now been so far completed that the results have been presented by the investigator to the French Academy of Sciences. The first step in these investigations, as reported by cable to the *Herald*, was the inoculation of a rabbit with a fragment of tissue taken from the spine of a rabid dog. The incubation of the poison occupied fifteen days. As soon as the animal died, a portion of its spinal marrow was in turn inoculated into a second rabbit, and the process continued until sixty rabbits had been treated. Each inoculation increased the power of the virus, so that the last incubation occupied but seven days. As dried air diminishes the power of the virus, the spinal marrow of the inoculated rabbits was kept in bottles of dried air. In beginning his experiments, therefore, M. Pasteur inoculated his subject with the old tissue, and finished the operation by the injection of tissue that had been bottled only two days, the period of incubation of which would not exceed a week. These experiments have been very successful, for after such an inoculation the subject is found to be entirely proof against hydrophobia. An excellent opportunity to test the new treatment was afforded by a lad, twelve years old, named Meister, who had been bitten fourteen times by a rabid dog, and who was brought to M. Pasteur. As there seemed no doubt of a speedy and painful death, should nothing be done for the child, he was considered a proper subject for experiment. In thirteen days, the inoculations made upon the lad were gradually increased in strength, until the last was from a rabbit that had only died on the previous day. At the end of a hundred days, the lad was in perfect health, and the experiment was pronounced a decided success. Another lad, named Judith, who was fifteen years old, and had been bitten by a mad dog, was progressing satisfactorily after a week's treatment, and a fortnight from the time of the accident. To carry this system into effect, it will be necessary to have rabbit farms established, where the animals will be kept constantly inoculated with the disease, just as we now have bovine farms for the production of vaccine virus. Two lines of treatment are mentioned, the inoculation of human subjects and the blotting out of the disease by the compulsory inoculation of dogs for several generations. The origin and nature of hydrophobia are understood but imperfectly, and it is too soon to make any definite assertions in regard to M. Pasteur's system. It is probably but the first link in a chain of elaborate investigation. The honor, however, in such unique inquiries is to him who breaks the ground.

WAR BALLOONS.

At a recent meeting of the Military Service Institution, held at Governor's Island, Gen. Russell Thayer, of Philadelphia, presented in detail his system of independent and dependent dirigible balloons, intended particularly for use in war times. General Thayer has made many experiments in aerial navigation, and has so far been successful that a number of his designs and working models are now under consideration at the British War Office.

The independent balloon is for observation chiefly, and has sufficient carrying force to enable it to drop powerful explosive bombs upon the fleet or camp of an enemy, and cause greater destruction than the most formidable fortifications. The buoyant part of the balloon is made of superimposed tissues of silk or rubber, or vegetable textures impregnated with caoutchouc, to prevent the escape of hydrogen.

The form is that of a circular spindle, the longer horizontal axis of which should be three and two-thirds that of the smaller. The body is at all times perfectly inflated, so as to remain rigidly in shape. The suspended deck, carrying the machinery and crew, is firmly supported and braced. A lower deck carries the motive power. When the machinery is in operation, the balloon can be raised or lowered to any elevation without employment of ballast. Four cylinders located on the upper deck receive a portion of the hydrogen from the inflated bag of the balloon when it is desired to lessen its buoyancy, and consequently descend. To ascend, the gas is pumped from the cylinders into the bag, and by displacing the heavier air of the surrounding atmosphere, the buoyancy is increased.

The motor is a high pressure air compressor coupled directly to a newly devised carbonic acid gas engine and a reservoir for storing the air until sufficient pressure is obtained. At given intervals of time, the compressed air is suddenly released, producing a powerful forward thrust. As the carbonic acid gas engine uses no coal, danger from fire is entirely avoided. This is particularly important, since mixtures of hydrogen and air are so terribly explosive. The air being discharged at the stern through a pipe and nozzle fitted on a ball and socket joint, the direction of the air ship is determined by a wheel governing the movement of the pipe and nozzle. No other rudder is necessary. The efficiency of the mechanism is increased materially by placing hollow, truncated cones over the nozzle.

Gen. Thayer expressed his belief that air ships, even 1,000 yards in length, could be operated without difficulty, since the resistance does not increase in proportion to the size of the ship. Last year the United States Ordnance Board recommended the construction of an experimental balloon, 100 feet in diameter and 367 feet long. Such a ship would have a total ascending force of about 55 tons. It is thought that a speed of 50 miles an hour could be obtained. Gen. Thayer's model, being 30 feet long by 10 feet in diameter, was not placed on exhibition, as the assembly room was scarcely capacious enough.

The construction of the dependent dirigible balloon is similar to that of the independent ship except the motive power, which is here electricity. The track consists of two parallel wires supported on poles above the ground. The lower deck would be provided with two large wheels constructed to run on the under side of the wires, and two small wheels to run on the upper side. This arrangement anchors the balloon to the earth, and furnishes the motive current from a dynamo at the end of the line.

It is expected that a speed of at least 20 miles an hour could be obtained. A model of the balloon and track was shown, and by making the connection was operated successfully. These experiments have attracted much interest, and have inspired a confidence in their ultimate success when put into practice.

ACCORDING to *La Lumiere Electrique* Mr. L. Senet has invented a new process that permits of the manufacture of aluminum, as well as copper, silver, etc., by electrolysis. A current of from 6 to 7 volts and 4 amperes is made to act upon a saturated solution of sulphate of aluminum in the presence of a solution of chloride of sodium, the two solutions being separated by a porous vessel. A double chloride of aluminum and sodium is formed, which is decomposed, and the aluminum that is set free deposits upon the negative electrode.

NIGHT SKY—NOVEMBER AND DECEMBER.

BY RICHARD A. PROCTOR.

The Great Bear (*Ursa Major*) is beginning to rise above the northeast (by north) horizon. The end of the Dipper's handle is hidden. A line from the Pole Star (toward which the Pointers direct the observer) to the Guardians of the pole, β and γ of the Little Bear (*Ursa Minor*), is now in the position of the minute hand of a clock 27 minutes before an hour. The stars of the Dragon wind round below the Little Bear toward the west, the head of the Dragon with the gleaming eyes ("oblique retorted that askant cast gleaming fire") being low down, a little north of northwest. Above is King Cepheus, and above him his queen, the Seated Lady, *Cassiopeia*, their daughter, the Chained Lady *Andromeda*, being nearly overhead.

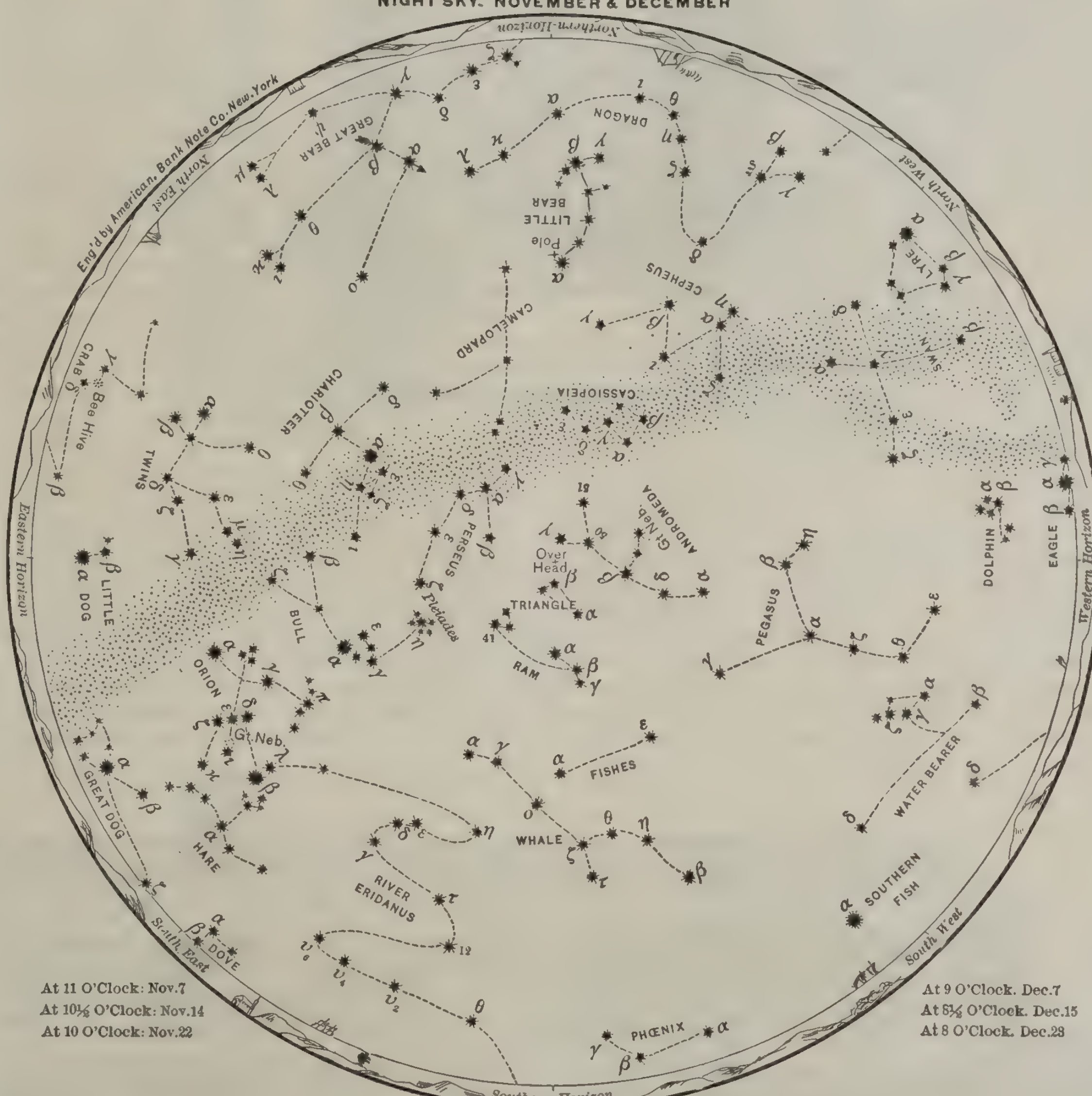
Low down in the northwest we see the Lyre (*Lyra*), with the bright Vega, and close by toward the west the Swan (*Cygnus*), or Northern Cross. The Eagle is setting in the west, and the Little Dolphin nears the western horizon.

Toward the southwest (by west) we see the Water Bearer (*Aquarius*), with his pitcher (β, γ, α), close by which is the head of the Winged Horse (*Pegasus*). In the south, low down, is the absurd Phœnix; above, the Sea Monster, or Whale (*Cetus*); above him, the Fishes (*Pisces*); above them the Ram (*Aries*); while nearly overhead lies the Triangle.

The river *Eridanus* occupies the southeasterly sky, the Dove and Great Dog (*Columba* and *Canis Major*) rising in the southeast. The glorious Orion has now come well into position, though not yet so upright as we could wish a knightly hunter to be. He treads on the Hare (*Lepus*), and faces the Bull (*Taurus*) above.

Due east we find the Crab (*Cancer*) and Little Dog (*Canis Minor*) low down; the Twins (*Gemini*) higher; above them the Charioteer (*Auriga*), with the bright *Capella*, and *Perseus* the Rescuer nearing the point overhead. In the midspace between Perseus, Auriga, and the two Bears we find the ridiculous constellation *Camelopardus*, or the Giraffe.

NIGHT SKY: NOVEMBER & DECEMBER



At 9½ O'Clock: November 30

In the map, stars of the first magnitude are eight-pointed; second magnitude, six-pointed; third magnitude, five-pointed; fourth magnitude (a few), four-pointed; fifth magnitude (very few), three-pointed, counting the points only as shown in the solid outline, without the intermediate lines signifying star rays.

Asphalted Jute.

According to the *Journal des Fabricants de Papier*, a material called asphalted jute is being largely employed in Germany for covering roofs, for isolating damp walls and floors, and for preventing bad odors from reaching apartments situated over stables, etc.

It consists of strong jute cloth coated with specially prepared asphaltum, and covered on each side with strong asphaltum-coated paper. In order to obtain a very compact product, the whole is submitted to very strong pressure.

The material can be used on farms for making tight reservoirs, in the construction of bridges, and in many other cases where there is need of a material that is at once strong, impermeable, and cheap.

Hon. Thomas A. Hendricks.

It is with deep regret that we record the death of Hon. Thomas A. Hendricks, Vice-President of the United States. After a very brief illness, he expired at his residence in Indianapolis, on November 25th. For some time he had suffered from a slight paralysis of the left hand, and it is thought that his death was caused by instantaneous paralysis of both heart and brain. Mr. Hendricks was born in 1819, at Zanesville, Ohio; studied at Hanover College, and, after completing his law course, was admitted to the bar of Indiana. He was at different times a member of the Legislature and of Congress, the Commissioner of the General Land Office, a National Senator, Governor of Indiana, and was twice chosen to be Vice-President of the United States.

THE Seventy-six Canal Company of California are to build a branch canal at Tulare County, 18 miles long and 60 feet wide.

Whitening Walls.

The *Deutsche Bauzeitung* has lately commented upon the dangers resulting from the use of certain substances in whitening walls, as well as from the size and other compositions used in paper hanging, etc. From the fact that painters' brushes are injured by lime freshly slaked, they often mix with it organic substances, which are liable, it is considered, to cause infection. The same remarks are applied in a general way to paperhangers. These disadvantages can, it is said, be obviated by adding one-tenth of a pound of boric acid to each gallon of ordinary milk of lime. This addition has the advantage of preventing the appearance of stains when paper or size colors are applied to walls not sufficiently dry. In cases of disinfection it is necessary for special care to be exercised as to purity of the lime used.

Interesting to Architects and Builders.—Comfortable Homes.

For many years past the "Baltimore" has been one of the best known and most popular of the fireplace heaters in use. For heating houses of moderate size it possesses advantages in its economy of fuel, moderate first cost, healthfulness, and beauty of design and finish, that easily account for the large degree of public favor it has received. It was originally a distinctive Baltimore invention, from which it took its name; but its manufacturers, Messrs. B. C. Bibb & Son, of that city, have introduced various new features in its construction, whereby the fire can at all times be regulated with the least possible attention, for the maintaining of a uniform temperature, with a minimum consumption of coal, while the heater will not only warm the lower rooms of a house, but two and sometimes three chambers above. It is, in fact, a miniature furnace, put in the fireplace or chimney flue, the same as a grate, and is furnished with or without a mantel, especially made to harmonize with it in appearance, and thus add to the furnishing and decoration of a room. The chimney flue may be used as a conductor of heat to the rooms above, or a tin heat pipe may be run through the chimney to the registers in the upper rooms. These heaters are self-feeding, and require so little attention that those using them frequently keep their fires going through the whole season without once having to rebuild a fresh fire, while they have an illuminated front which gives the cheerful appearance of a low iron grate in a room, with none of the dust and dirt which are such serious drawbacks to an open grate fire. The grate is so arranged that the clinker can be removed without disturbing the fire, and an improved slide has been added by which the ashes can be dropped directly into a receptacle in the cellar if so desired.

The "Baltimore" heater is in such demand that a majority of new houses in Baltimore and Washington less than 25 ft. front are supplied with and entirely warmed by them.

Messrs. B. C. Bibb & Son, Nos. 39 and 41 Light St., Baltimore, Md., are the inventors, patentees, and manufacturers of these improved heaters, the above company being the pioneers in this line, having been thirty-four years in the business.

Ammonia and Alcohol in Snake Bite.

Writing to the *Medical Times* from the Delaware Water Gap, where poisonous snakes abound, Dr. J. B. Shaw says that he was called to see a child, aged 10, female. She was bitten by a copperhead on the foot, about one inch above the middle toes. He saw her in four hours from the time she was bitten. Her symptoms then were: Extreme prostration with nausea; respiration very slow; pulse weak; eyes fully dilated, with a wild look. The foot and leg were very much swollen and purple, and very painful.

He gave her 60 minims of spts. ammon. aromat. hypodermically, ordered one ounce of whisky every two hours, and a large poultice of bruised raw onions to be applied to the foot and to be renewed every hour. The whisky and onions were kept up until the child was well, which was on the third day.

The above has been his treatment for the last six years, and he has never lost a case; nor has he heard of a death from snake bite where the treatment has been carried out.

Unmagnetizable Steel.

Mr. J. T. Bottomley has made some experiments with a piece of steel made by Messrs. Moses Eadon & Sons, of Sheffield, under Hadfield's patent, containing 15 per cent of manganese. One side of the specimen has been polished, and shows that the steel is capable of taking a very high finish. The present specimen has a tensile strength of 45 tons to the square inch. To test it magnetically, the bar was first "touched" with steel magnets, but these had evidently no effect upon it. It was then placed between the poles of a powerful Ruhmkorff electro-magnet, excited by forty large tray Daniell cells arranged in fours for quantity, and ten in series. The bar was, however, still unaffected by the magnetism, as far as could be perceived by the hand. On testing it by a delicate magnetometer, however, it was found to show a slight trace of magnetism. The magnetization per gramme was found to be 0·013 C. G. S. (centimeter-gramme-second) units, whereas some specimens of steel show 50 to 100 C. G. S. units per gramme.

The Hartford Steam Boiler Inspection and Insurance Co.

An examination of the financial resources of the Hartford Steam Boiler Inspection and Insurance Co., made during the past summer by A. R. McGill, the Insurance Commissioner of Minnesota, and J. J. Brinkerhoff, the Examiner for Illinois, shows the condition of the company to be in every sense satisfactory. It had on the 10th of August, $527,194.55 of good interest-paying assets, and, aside from its capital stock of $250,000, but $172,561.53 of liabilities. The investments of the company have all proved to be excellent, and the management has shown rare skill and ability in keeping the losses down to a minimum. This is due largely to the company's thorough system of inspection, by which the expenses are limited in a large measure to the preventive department. An investigation by outside examiners was deemed advisable, on account of adverse reports circulated in the Northwest by an unscrupulous competitor, but the report now made public will completely silence such an unworthy attack.

IMPROVED METHOD OF BURNING LIMESTONE.

We herewith illustrate an improved kiln for burning limestone, which, both in its construction and operation, possesses features that are new and of great value; but more important is the fact that the lime produced is of absolute purity. The stone during its passage down the kiln is subjected to the intense heat of hydrocarbon burners, and, the combustion being perfect, there is no opportunity for the introduction into the lime of any deleterious ingredient, such as sulphur; and as the stone from these quarries, which have been worked for over seventy years, is second to none in Pennsylvania in purity, the lime obtained is of the best quality. The white efflorescence often seen disfiguring the walls of buildings is in some cases caused by carbonate and sulphate of soda and potash; General Gillmore, in his "Treatise on Limes, Hydraulic Cements, and Mortars," states that one source of these salts is, "beyond doubt, the hydraulic lime or cement used in the mortar, derived partly from the stone itself, and partly from the ashes of the fuel used in calcination." It will be seen that this method of burning is free from all danger arising from "the ashes of the fuel used;" and even if the limestone were of a poor quality, the hurtful elements would be eliminated in the burning.

Additional evidence is contained in a report by Mr. Wm. Trautwine, under the title of "Incrustations on Brick Walls," which gives the results of an investigation made by him into the cause of the defacing of the buildings in Philadelphia. He attributes the discolorations to the use of a lime in building composed of a large percentage of magnesia, and burned with wood and coal conjointly, or coal alone, the sulphur from the coal being very injurious to lime.

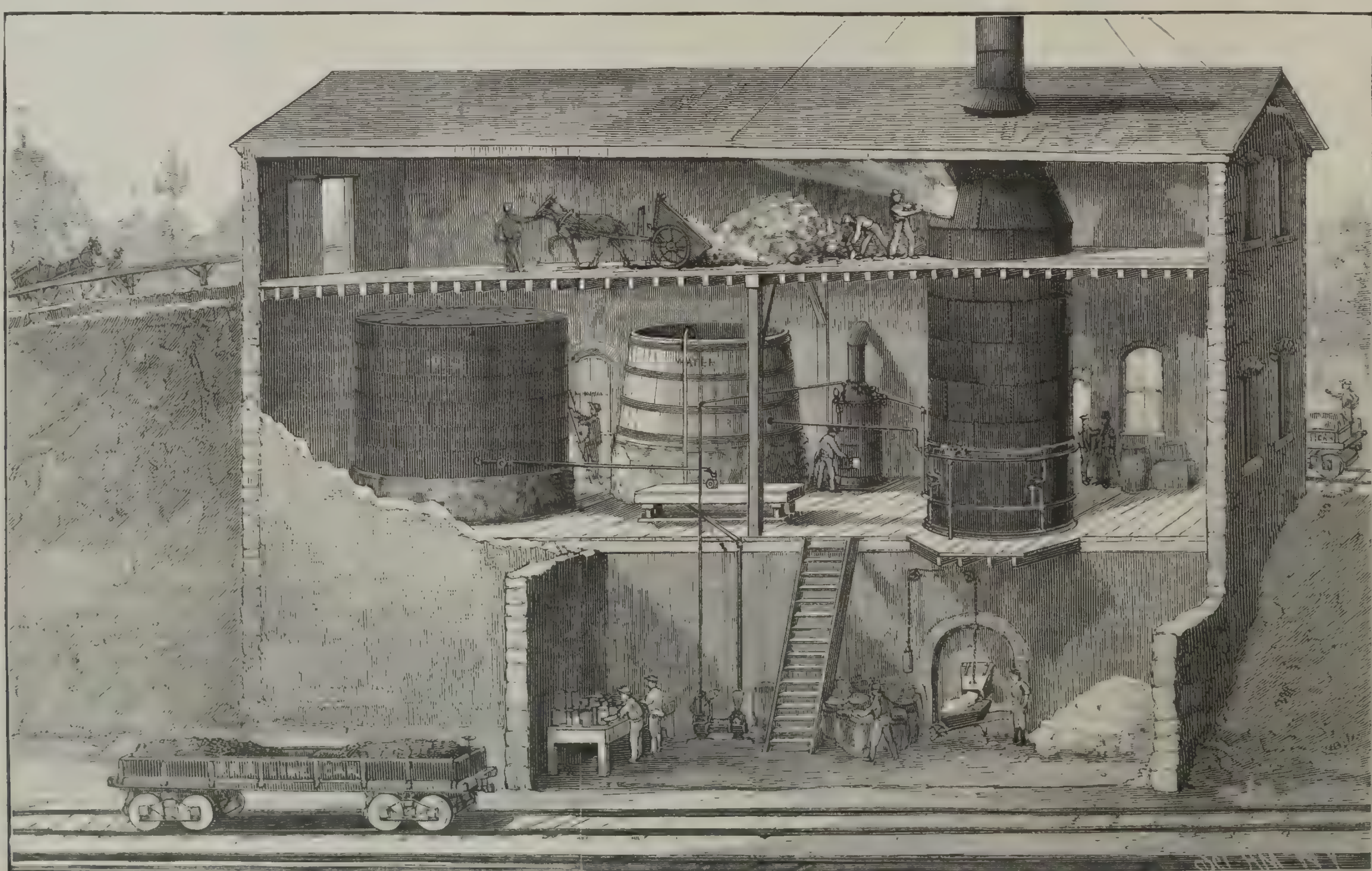
The kiln proper consists of an iron shell lined with fire brick; the upper part tapers off, and terminates in an ordinary stack passing through the roof of the building. As shown in the engraving, the kiln extends from the ground floor through the second and third. The burner openings—four in number—are made through the shell and lining at a convenient height above the second floor and at equal distances apart. In each opening is placed a hydrocarbon burner, similar in construction to the ordinary atomizer, and consisting of two small pipes arranged at right angles to each other, and with the outlet ends in close proximity to each other. The vertical pipe connects with an oil circle extending around the kiln just within or without the iron shell and below the floors of the burner openings. This circle is connected by a pipe with an auxiliary tank, rectangular in shape (shown in the center of the cut), which is supplied with oil—crude petroleum—from the main reservoir located in one end of the building. The oil flows by gravity from the reservoir to the auxiliary tank, which is at such an elevation that when full the oil surface is a few inches below the burner outlet. Each horizontal pipe of the burners is connected with a steam pipe encircling the kiln just below the burner openings, and supplied with steam by the boiler.

Immediately below the steam circle is another connected with it, which carries away water of condensation. Fed by the water tank, shown in the center of the picture, is a large pipe encircling the kiln above the burners. From this circle a smaller pipe leads to each opening, where it connects with a water back; from the outlet of each water back a pipe leads to a waste-water collector. By this means a constant circulation of cool water is maintained through each water back, and the brick lining adjacent to the flame is protected from the effect of the intense heat. Suitably located valves control the admission of steam and the flow of oil and water to the kiln. The steam, in its passage across the opening in the vertical oil pipe of the burner, draws up the oil, which enters the kiln as a fine spray; upon being ignited, an intense and equal heat is obtained, which burns the limestone as it gradually passes downward through the kiln.

Limestone from the quarry, but a short distance away, is brought upon cars to the level of the upper floor; from here it is fed to the kiln through a door in the upper conical portion. The degree of heat to which the lime in its passage is submitted increases as the burners are approached. Above each burner opening is a peep hole, through which the condition of the interior may be observed. The lower part of the interior of the kiln tapers downward, and terminates in a chute, provided with a weighted door, and through which the lime is drawn. The lime is stored upon this floor, or packed ready for shipping; a track leading to one of the branches of the Pennsylvania Railroad passes before the door of this apartment. The lower portion of the kiln could, if thought desirable, be so constructed as to form a capacious storage chamber, in which the lime would be perfectly protected, and from which it could be easily drawn as needed.

From the above brief description it will be seen that all the parts are simple, the heat may be regulated to a nicety and may be maintained for an indefinite period, and that the kiln is continuous in its action. The limestone is subjected to what may be termed a cleansing process, and the lime is delivered in a pure state.

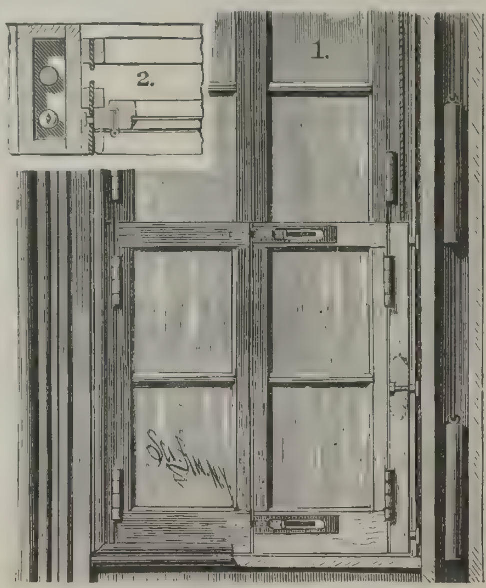
This invention has been patented by Mr. Joshua Hunt, and is controlled by the Baker Lime Co. (Limited), of Avondale, Chester Co., Pa., whose kiln our engraving illustrates. The general agents of the Baker Lime Co. are the Jackson Lime and Coal Co., of Wilmington, Del.



IMPROVED METHOD OF BURNING LIMESTONE.—KILN OF THE BAKER LIME CO.

AN IMPROVED WINDOW.

To the window casing, which is formed with weight boxes in the ordinary manner, are attached guards forming grooves for the sashes to slide up and down in. Each of the sashes is made in two parts, rabbeted at their inner and outer edges to form close joints, and hinged at their outer edges to pieces fitted to slide up and down in the grooves in the casing. To each hinge piece are attached two or more bolts formed with flat heads, which project at the inner sides of the pieces so far as to underlap the adjacent edges of metal guide plates secured to and between the guards and casing, as clearly shown in the sectional plan view. When closed, the sashes are held together by bolts, as shown in the large view. With this construction the sashes can be raised and lowered with the same facility as ordinary sashes, and can also be swung open and shut upon the hinges, so that the outer sides of the window can be readily washed and the window can be fully opened in warm weather to admit air to cool and ventilate the apartment, and quickly closed when required.



BUCKNER'S IMPROVED WINDOW.

This invention has been patented by Mr. M. S. Buckner, of 154 Hull Street, Savannah, Ga., who will furnish all further particulars.

Andromeda's Loss.

The new star in Andromeda, which was first seen by Ward, at Belfast, on August 19, as a star of the ninth magnitude, and two days later reached its greatest brightness as one of the seventh magnitude, is now fading at the rate of one magnitude in eighteen to twenty-one days, and has reached the lower brilliancy of a star of the eleventh magnitude. Monck has suggested the hypothesis that the stranger may be a dark star raised to incandescence by passing through the matter constituting the nebula, or may be a condensation of meteoric streams. Or it may not be in the nebula at all. If it is really passing through Andromeda, the length of its duration shows the enormous size of the nebula, since it must be going across the thin portion, the diameter of which is, nevertheless, forty or fifty times as great as the distance of the earth from the sun, or about four and a half billions of miles. Similar dark stars have been previously observed.

SOME one suggests the brilliant idea of chaining a Bible to each telephone in the country, so that while waiting for replies the telephoners will have something to read of a nature to repress profanity.

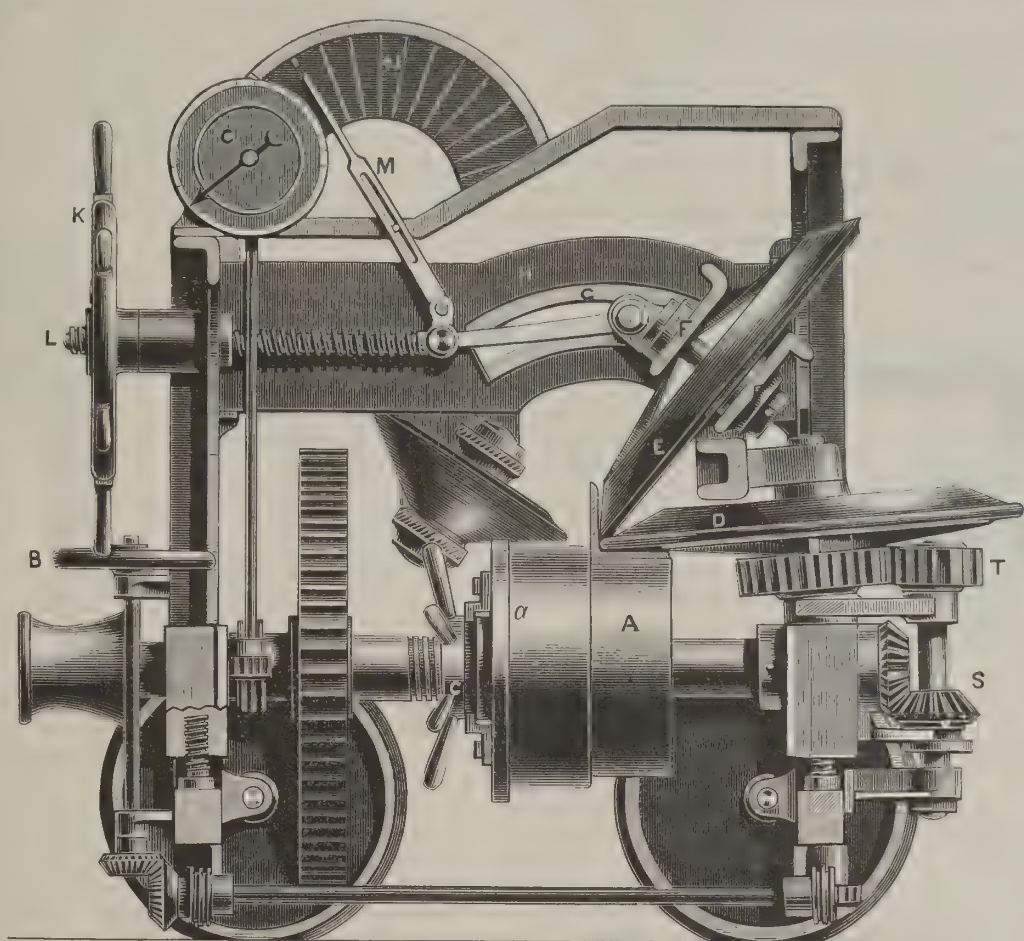
MACHINE FOR BEVELING ANGLE BARS, ETC.

Any one practically acquainted with shipbuilding, boilermaking, etc., will be aware that up to a recent date it has been and is still generally customary to bevel bars for the frames, reverse bars, keelsons, stringers, etc., for iron or steel vessels in a very laborious manner, with the use of tools worked entirely by hand; the angle has in the first instance to be guessed at by the workmen, then altered back or forward until it conforms with the bevel obtained from the body plan of the ship. When the bevel required to be put on a bar, and the curve to which it has to be bent, is considerable, several heats are necessary, the iron in the process becoming brittle and unsatisfactory. Frequently the bar is broken and the labor at all events lost, as usually iron manufacturers only replace the material, and do not allow for the labor expended. In any case, the work when it is done by the ordinary method is far from being satisfactory, the bars becoming hollow in the flanges, thus—

instead of being perfectly flat, so that, when the work is put together, the riveters are compelled to ply the bar with quarter hammers so that it may be made to fay close; and while doing so the bars are frequently fractured, which if detected leads to them being condemned, or doubling pieces have to be fitted as compensation. Arthur's patent beveling machine overcomes these practical difficulties to good beveling, and has already been tried, approved, and adopted by several large shipbuilding firms. The patentee is a practical iron shipbuilder, being at present a foreman plater with Messrs. Ramage & Ferguson, who have adopted the machine. The need of some better means of beveling angle and other bars has often occurred to Mr. Arthur, and this machine is the result of much thought and experiment on his part.

The machine which we saw at work was mounted on rails in front of the furnace, and when in use is brought up opposite the furnace mouth. It draws the bar out of the furnace (a saving of manual labor), and the beveling process goes on simultaneously while the bar is still at its best heat, no time being lost as in the ordinary method by having first to secure the bars on the blocks. It bevels straight out from the heel, and smooths down the rough edges of the rivet holes, so that the rivet head gets close up to the neck and the work fays close. The beveling is done correctly and at once, so that the result is smooth, clean, and accurate work; and the operation being done by rollers when the bar is hot, the edges are fair and free from local strains, which are always put on bars beveled by the old fashioned way, the beveling occupying just about the same time as in the ordinary method is taken in merely drawing the bar out of the furnace.

The bar when it has left the machine is sufficiently hot to be turned without reheating, and is easily wound or turned fair to the set, so that it is therefore free from kinks. It is claimed by the patentee that the work is done with a saving in labor alone equal to about 50 per cent, and there is no doubt that there is a very great saving in the labor expended in beveling. The machine is very compact, lightly but strongly constructed, and so simple that any workman can use it.



MACHINE FOR BEVELING ANGLE BARS, ETC.

The machine we saw in operation was being used to bevel 6 in. by 4 in. frame bars, and the frame turner using it was doing so for the first time, and had found practically no difficulty in understanding how to manipulate it, and expressed himself thoroughly satisfied that it did much better work than can be done by the old, crude method; and seeing the patentee was a perfect stranger to him, and he has no interest whatever in the machine, such an expression of opinion speaks for itself.

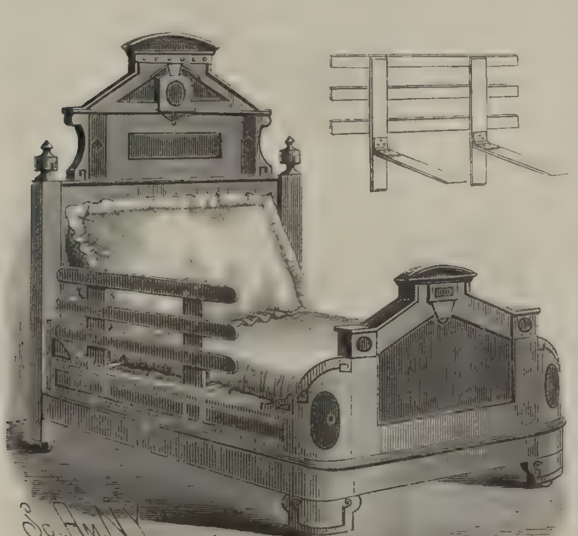
We append an illustration showing a sectional view of the machine, with part of the gearing and guide rollers removed, and with a bar in the position for open-beveling; when it is required to shut-bevel, the bar is fed through the machine with the horizontal flange in the opposite direction to that shown in the drawing, so that the edge will lie toward the collar, *a*, of the roller, A, and this roller is then adjusted horizontally to bear up on the edge of the bar. The most important parts of the machine are the conical rollers, D and E, of which the roller, D, holds one flange or wing of the angle bar horizontal, while the other roller, E, regulates the angle of the other wing of the bar. The angle is determined beforehand, and indicated by the pointer, M, on the sector, N, which is provided with a scale. The position of the roller, A, is adjusted by the hand wheel, B, and the screw collar, C, according to the thickness of the bar. By means of the collar, C, the roller, A, can be moved toward or from the conical roller, D; and by means of the hand wheel, B, the roller, A, can be adjusted vertically.

To regulate the angle of the bar, the screw, L, is turned, thus moving the summit of the cone, E, in the slot, G, formed in the cross-bar, H. The pointer, M, is connected at one end to the screw, L, and, as stated above, indicates on the sector, N, the angle formed by the two wings of the bar. This angle can be varied in different parts of the bar; and in this case the angles are taken on the plan of the ship at equal intervals in the length of the bar to be shaped. A disk, O, provided with a pointer indicates the course taken by the bar in passing through the machine. Note is taken in advance of the angles which correspond to each point of the bar, each of these points being designated by a number, and these numbers are placed on the disk, O. When the machine is to be operated, a bar is placed between the rollers, D and A, which revolve, and thus draw said bar into the machine. As the points which have been marked occur at regular intervals, it can easily be seen on the disk, O, when one of these points arrives at the rollers, at which moment the operator regulates the position of the roller, E, so that the pointer, M, will indicate on the sector, N, the angle corresponding to the desired angle of the bar at said point.

The machine draws the bar from the furnace when it has reached the desired temperature, and for this purpose guide rollers are provided, which are not shown in the cut.

THE SLEEPER'S GUARD.

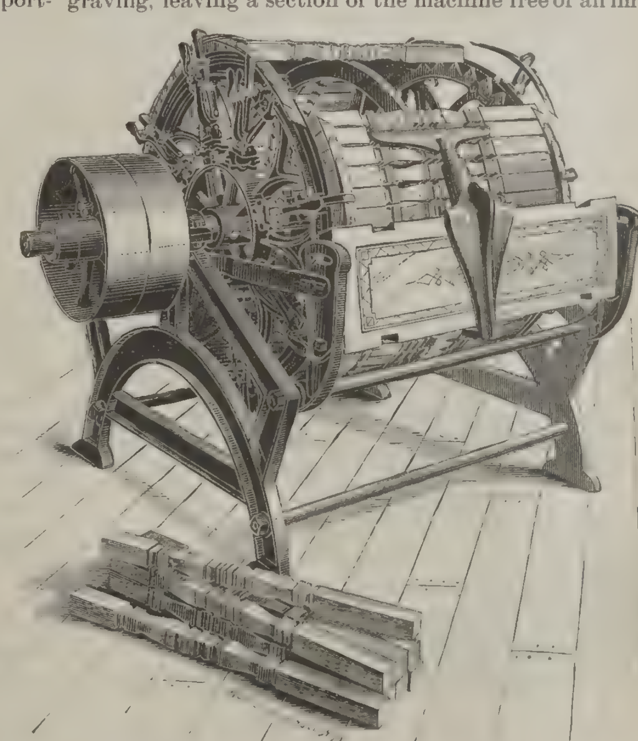
One, two, or three horizontal slats are attached to two upright bars, which are intended to be placed between the edges of the mattress and the side pieces of the bedstead or berth. Two folding arms are hinged to these uprights at points considerably above their lower ends, and when in use are arranged to be placed between the two mattresses of the bed, or when only one mattress is used, between the mattress and the springs or slats. The guard is shown in our illustration as adjusted to an ordinary bedstead. When not in use, the arms may be folded against the uprights, as shown, and the guard is readily portable or may be disposed of during the day by putting it under the mattress. The invention has quite a wide application. It is intended for use with ordinary beds, or with the berths of sleeping cars and steamers, to prevent the occupant, and particularly children, from falling out and being injured or crippled. It is a very simple device, and when adjusted to the bed or berth, the sleeping persons are perfectly secure without recourse to pillows, chairs, or other uncertain contrivances. The guard has been patented by Mr. John C. McMurray, and is manufactured by the Sleeper's Guard Co., 277 Pearl St., New York.



McMURRAY'S SLEEPER'S GUARD.

AN IMPROVED TURNING LATHE.

This lathe, shown in the engraving, is designed to turn work square or polygonal in shape instead of round. The machine consists of two wheels adjustably secured upon a central shaft. The materials to be turned are placed upon the wheels, thereby forming a cylinder. The wheels being revolved, one side of the pieces are cut to the desired shape. They are then turned over, and the other sides cut in like manner. The pieces are held on the wheels by a series of clamps or shoes, which are adjustable radially to enable them to clamp materials of different thickness. Each clamp is worked by a lever, which is quick and powerful in operation. A single movement of the lever will throw the clamp back out of the way, as shown in the engraving, leaving a section of the machine free of all impediments, enabling the operator to place materials thereon or turn them over very rapidly; and when in place, a single movement of the lever will securely clamp them to the machine and lock the clamp so that it cannot be thrown back. The machine has an adjustable middle support for the pieces, upon which they are firmly held, preventing all vibration and per-



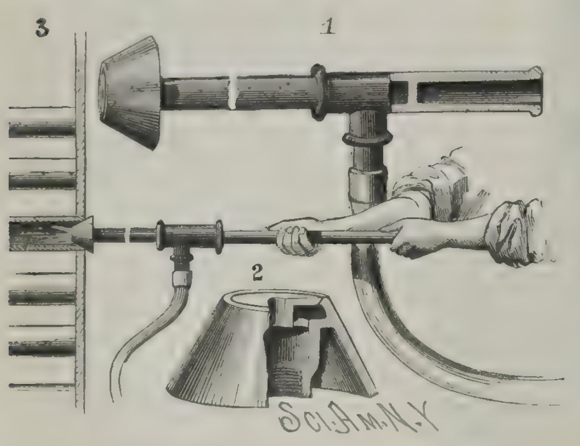
SMITH'S IMPROVED TURNING LATHE.

mitting of the finest work. The wheels are provided with adjustable seats, by means of which the pieces may be turned octagon or any other number of sides. The machine is so designed as to be easily and rapidly operated, and will finish smooth, with clean, sharp edges, from one hundred and fifty to six hundred pieces in ten hours.

This invention has been patented, and the machines are now manufactured by Messrs. D. C. & S. E. Smith, 227 West 5th Street, St. Paul, Minn.

BOILER FLUE CLEANER.

In the flue cleaner which we illustrate, the inventor has taken advantage of the cleansing power of a jet of dry steam, and has produced an instrument which is both effective and rapid in its operation. A truncated cone of cast iron, having the diameter of its base



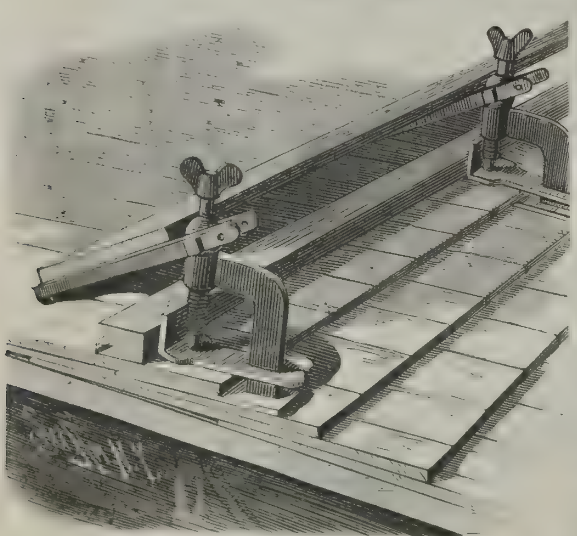
FERGUSON'S BOILER FLUE CLEANER.

somewhat greater than that of the flues to be cleaned, is screwed on the end of a section of tubing, which has a socket on its other end for the reception of a handle, and a right-angled neck for connection with a flexible steam pipe. This construction is shown in the first figure on a larger scale, and in the third figure as in actual operation. In the second figure, a portion of the truncated cone has been broken away, in order to disclose the internal arrangement. The neck of the conical nozzle is screw-threaded to make a tight joint with the tube section, and, by means of suitable braces, supports a disk at its face, provided with an annular opening and a central aperture for the discharge of the steam blast. The nozzle closes the mouth of the flue, excluding all air, and, by means of the openings in its disk, discharges a current of steam against the sides of the flue, sweeping out all obstructions and preventing the formation of scale. Where the cleaner is intended for use with an upright boiler, the handle may be arranged at right angles to the tube.

The device has been patented by Mr. J. M. Ferguson, 99 Camp Street, New Orleans, La., who will furnish further particulars.

CLAMP FOR ROOF SCAFFOLDS, ETC.

Attached to a plate which can be inserted under one of the shingles, as shown in the engraving, is an arm carrying a clamping screw having a bearing plate attached to its lower end. The bearing plate is slotted to receive the arm, and when borne down by the screw it serves to securely clamp the shingle between it and the lower plate. The upper end of the bearing plate is formed with a toe or upright, against which and



BARLOW'S CLAMP FOR ROOF SCAFFOLDS, ETC.

the corresponding toe of an adjacent clamp a "straight edge" may be placed when shingling the roof, to provide for laying the shingles perfectly true without the aid of a chalk line or any other guide. On each screw above the arm is a ball, to which is pivoted a support for the plank. This support consists of a bar slotted at one end where pivoted to the ball, and provided on the under side of its opposite end with any number of small pointed projections to stick into the roof to assist in holding the clamp in place. The clamps may be quickly and easily shifted from time to time to adjust them to different positions on the roof as the work progresses. It is claimed that one man by the aid of this device can lay 5,000 shingles a day, and that its use will result in a great saving of time and money. It can be used in laying tin or slate roofs, and by painters or tinners, and by farmers or others in repairing roofs. It does away with lumber for scaffolding and the labor of nailing the same. The clamp can be used in all kinds of weather, and would prove useful in case of fire in ascending the roof.

This invention has been patented by Mr. A. T. Barlow, of Marshfield, Oregon; further information can be obtained from Messrs. Crawford & Lockhart, of same address.

Crushing Limit of Columns.

In preparing a plan for an electric lighthouse, M. Bourdais, the architect of the Palace of the Trocadero, investigated the height to which a column of different materials could be raised without crushing under its own weight. The weight of a pyramid with a square base may be expressed by the equation:

$$P = D^2 \frac{h}{3} \delta$$

in which D represents the side of the base of the pyramid, h the height, and δ the density.

The resistance is: $R = \frac{P}{D^2}$

Hence $R = \frac{1}{3} h \delta$

$$h = \frac{3R}{\delta}$$

If we take for the limiting value of R one-sixth of the load, which produces crushing in iron, and one-twentieth for different varieties of stone, we may deduce the following table:

MATERIAL.	R.	δ.	H.
Porphyry	2,470,000	2,870	2,550 meters.
Iron	6,000,000	7,800	2,280 "
Granite	800,000	2,700	900 "

Such are the practical limits to which a pyramid might be raised in the respective materials. It is evident that the Egyptians, in the great pyramid of Cheops, stopped far below the limit. If the prismatic form were adopted, the height could be only one-third as great.—*Lumiere Electrique.*

Decay of Neglected Bridges.

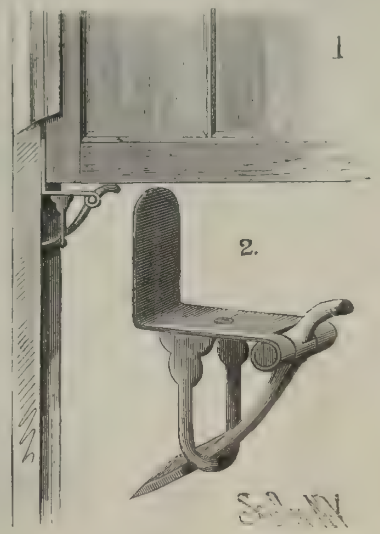
The rapid decay experienced by iron bridges which are neglected has recently been exemplified in Callowhill Street Bridge in Philadelphia. When lately the painters were set to work on this structure, their preliminary exertions in cleaning off the rust brought off flakes of oxide from one-fourth inch to three-eighths inch in thickness. This at once revealed the extent to which the injury had already gone, and called attention to the necessity of an immediate survey. The fact that the weakening process had already proceeded to a dangerous extent was shown by the vibration, which was so violent that the men had to hold on when a heavy load passed over, to avoid being shaken from the swinging stages. On examination, it was found that not only had rust invaded the material of the girders, but that the whole bridge, which is built on a rising grade, had moved down hill so far as to tear out the top courses of the upper abutment, and to buckle the struts of the intermediate supports, while the movements of the roadway had cracked the asphalt and forced out the paving blocks between the tram rails. The bridge crosses a railway, and provides for the street traffic above it; it includes one span of 340 feet. The structure was only completed in 1875, and thus ten years of neglect have sufficed to bring it to the verge of destruction.

Brick Walls.

Except upon sites where stone can be quarried in the immediate neighborhood, we are all familiar with the economical advantages possessed by brick over stone as a material for walls. A two-brick wall is equivalent in strength to one in solid masonry 2 ft. in thickness, and here is a saving of 6 in. in space on every average external wall—no mean consideration on a town site where the ground is valuable. That bricks absorb more moisture than most kinds of stone is admitted, but they do not retain it for so long a period, and it is consequently less liable to find its way through brick walls. But apart from this, there are methods of protecting brick walls from damp, which we should shrink from applying to stone. If we were to affix ornamental hanging tiles to the surface of a stone wall, such concealment of a fine natural material would be regarded as a piece of vandalism in art almost equal to the application of cement. Hanging tiles form one of the most picturesque of coverings for external walls, and greatly conduce to the appearance of home-like comfort which the exterior of a dwelling can be made to suggest; while, if glazed, they will not absorb moisture.—*Brick and Tile Gaz.*

PORTABLE SASH SECURER.

The form of this improved window sash fastener, which can also be used with advantage as a sash lock, is clearly shown in Fig. 2, while the manner of applying it to the window to hold the sash is shown in Fig. 1. In the outer end of a steel plate bent at right angles is pivoted a lever, one arm of which extends above the plate and is curved as shown; the other arm



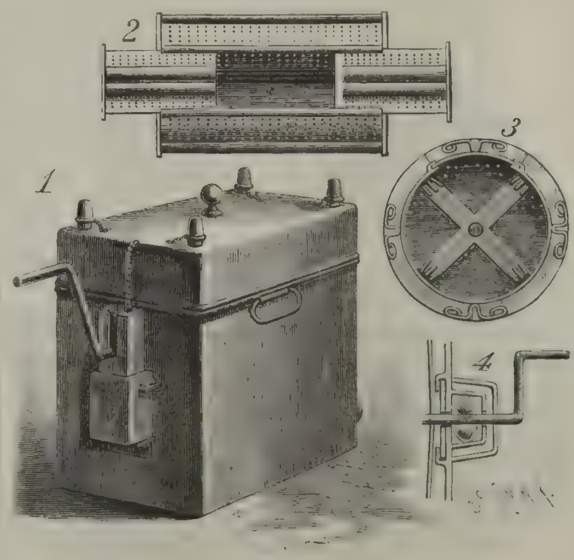
BETTERMANN'S PORTABLE SASH SECURER.

extends downward, and is made wider at its lower end and sharpened at the edge, so as to engage the guide rail of the sash when the device is placed in position for use. A U-shaped frame, riveted to the under side of the plate, prevents the long arm of the lever from dropping too far. To use the fastener, the sash is lifted and the upwardly bent portion of the plate inserted between the sash frame and the guide rail. The sash is then lowered so as to rest upon the short curved arm of the lever, when its weight throws the sharp lower edge of the lever against the rail, so as to bite into the same and thereby support the sash. To lower the sash, it is first lifted to permit the removal of the fastener. When used as a sash lock, the fastener is placed in an inverted position at one of the upper corners of the sash, when the latter cannot be opened from the outside.

This invention has been patented by Mr. R. Bettermann, of Cambria, Penn.

AN EASILY OPERATED WASHING MACHINE.

The illustrations herewith show a washing machine in which a perforated drum, holding the clothes, is placed in a boiler or reservoir containing soap and water, and the whole placed upon a stove and heated, when the clothes are washed by revolving the drum with a crank handle. Fig. 1 is a perspective view of the apparatus, Fig. 2 a plan representing the end covers partly drawn out, and Fig. 3 a transverse sectional elevation, Fig. 4 showing the working of the crank. The cover has an escape tube for the steam, with a cap to regulate its pressure, and there are ribs



ROGERS' IMPROVED WASHING MACHINE.

within the cylinder, which, as it revolves, raise the clothes and let them fall, and also cause the water to fall on them as the drum revolves; there are, besides, water elevators, formed by bent plates of galvanized metal, which take up the water and suds as the drum revolves, and cause it to pass through the perforations, so as to fall upon the clothes. This invention has been patented by Mr. Henry B. Rogers; particulars can be had from Messrs. Potter & Son, of Marshall, Mo.

REPAIRING THE COOPER INSTITUTE.

So well known is the aim of Cooper Institute, and so widespread has been the good accomplished during the thirty-two years of its existence, that any statement regarding its work, except of the most general kind, would be superfluous. Founded by the philanthropist Peter Cooper, and amply endowed by him, it is devoted, with its entire income, to the instruction and elevation of the working people of New York city, irrespective of age, sex, or condition.

The building occupies a whole block, being 86 feet on Seventh Street, 155 feet on Third Avenue—the front shown in our frontispiece—143 feet on Eighth Street, and 195 feet on Fourth Avenue. Originally there were but five stories and a basement, the latter containing the large lecture room, which is 125 by 82 feet and 21 feet high; but a few years since, an additional story was placed over the entire building, two stories were raised over a part of the Third Avenue side, and the southern end (to the left in the engraving) was raised to a total of eight stories. This additional load, together with errors in the design, made necessary the extensive repairs which have been in progress for several months, and which are now nearing completion.

The piers supporting the walls facing the avenues were placed beneath the center lines of the window spaces of the third or reading room story, and also beneath the piers of the third story. The piers under the window spaces thus had but little or no load to carry beyond their own weight, and, as a natural consequence, the lintels and window sills were fractured by the strains produced by the bearing piers moving downward, thereby causing an upward reaction through the line of the intermediate ones, or those having no load. To remedy this defect, which is by no means an uncommon one, even in buildings of recent date, all the bearing piers were removed, and others were built having a larger section and an increased area of foundation, while the flat lintels of the second story were replaced by segmental stone arches. During this work the walls were supported upon shoring, as shown clearly in the engraving. Beneath the lower portion of each of the third story piers were placed two pairs of heavy iron I-beams 15 inches deep and two sets of heavy yellow pine timbers. The interior shores extended from floor to floor to the basement, where they rested upon a crib formed of timbers; the large foundation area thus obtained rendered easy the adjustment of the shores by the screws. Outside there were two shores to each needle, and where there were vaults under the sidewalk, the arches were centered, and held by shores. Struts were wedged across the lower part of each window space.

The ceiling of the lecture room was supported upon three rows—parallel with Fourth Avenue—of cast iron columns, 12 inches in diameter, spaced 18¾ feet apart; at right angles to the rows, the columns were 18 feet apart, and the outer rows were 20⅝ feet from the piers. Upon adjacent columns, and in a direction perpendicular to the avenue, were two brick arches (shown in Fig. 9), the space between which was filled in; the lower arch was designed to carry the ground floor, and the semicircular one served to distribute the weight of the dividing walls and the piers and columns which extended upward through the several stories of the building to the columns. The piers upon which the outer line of arches rested were so narrow that the line of thrust fell outside the base, and the pressure was not transmitted to the retaining wall, owing to the height at which the arch joining the wall and piers was placed. As repaired, the foundations of the piers are 10¾ feet square, and the arch is so curved, as shown in Fig. 8, which represents the lecture room finished, with the exception of the floor, that the line of thrust falls well within the base. In both the new and old constructions, Figs. 8 and 9, the thrust is indicated by the dotted lines. After this row of arches had been completed, the upper walls were found to be too weak to carry the load; the arches were then centered, and were supported by vertical and radial shores, while the adjoining ones were put in. All of these arches are of cut stone.

The columns were originally supported upon foundations consisting of an upper granite block 2 ft. square by from 11 to 12 in. thick, and by an under block, which in several instances was divided, 4½ by 4⅔ ft., and 16 in. thick. The upper block is now 4 ft. 8½ in. by 4 ft. 10½ in., and 1 ft. 10 in. thick; the lowest course of concrete is 8 by 9 ft. (The entire building rests upon sand, and in every case the foundations of the piers and columns have been increased in area and extended deeper.) The columns are of cast iron, 16 in. in diameter.

The plates and wedges used with the columns are shown detached and separated in Fig. 5 and in position in Fig. 6. Wedging similar in principle to this, but in form corresponding with the situation, was used at the front walls for the removal of the shores and elsewhere in the building. The facing surfaces of each plate are recessed to receive the wedges, which are sharp and planed true; a slight tap with a small hammer upon each wedge successively brings each to a bearing, and insures an even distribution of weight. The plates were bedded in pure Portland cement. The columns in the reading room in the third story were directly over the outer rows in the basement, and that portion of the room between these columns—37 ft. wide and 90 ft. long—passed through the third and fourth stories. The ceiling over this space, Fig. 2, was held by girders supported at the end upon columns and at the center by rods from the roof. These girders at the ends of the reading room, as shown in the cross sectional view, Fig. 4, and at *b* in Fig. 2, were made up of two deck beams each 7 in. deep, put bulb to bulb and held by bolts through the flanges. A permanent deflection averaging about 2 in. had taken place. These are reenforced by the placing of two heavy I-beams, one at each side, as shown in the section, Fig. 3, and at *a*, Fig. 2. To relieve the roof a center row of columns has been erected. While the repairs in the reading room and the strengthening of the walls in the lower stories were going forward, the central portions of the floors were cut away. The columns in the reading room were carried by shores extending to the basement floor. About the upper part of the column were firmly bolted the carefully fitted sections of an iron jacket shaped as shown in the upper part of Fig. 7; the shores bore against the extended under side of this jacket, and held the column during the building of the new wall.

In the foregoing we have attempted to describe only the main features of the principal changes, and to briefly mention the causes making them necessary. This building was the first one in which iron was used extensively; and owing to the experimental condition in which the use of this material then was, there crept into the design errors in form and proportioning which the experience of later years enables the builder to steer clear of. All such parts have been either entirely removed and rebuilt, or have been strengthened. During the repairs, the load in every case has been carried to the basement by shoring always placed vertically in line, thereby obviating the risk of having an unusual weight brought upon the floors. All the division walls and the columns have been carried up vertically in line with the basement columns, and have been made of such size as to insure ample strength.

It is estimated that these repairs will cost in the neighborhood of $250,000, the building costing originally $650,000; this expense thus far has been borne by a few gentlemen whose names we are not at liberty to give, but to whom all praise is due for their generous and unostentatious support of so good a work. The architect under whose direction the work has been most successfully prosecuted is Mr. Leopold Eidlitz. Mr. J. H. Smith is the builder, and Mr. Isaac Whitenack, the foreman of masons.

PHOTOGRAPHIC NOTES.

Increasing the Sensitiveness of Orthochromatic Plates.—From recent experiments described in the *Photographische Wochenblatt* by V. Schumann, and translated by the *Photographic News*, it appears plates prepared with a bromo-argentic emulsion containing also an ammoniacal solution of eosine are not as sensitive to yellow and red colors as those coated with the ordinary Eder silver, oxide, ammonia emulsion, and then dipped for two or three minutes in an aqueous solution of eosine to which a little ammonia is added. After immersion, the plates are dried and then exposed in the camera.

The pyro and potash developer is preferred, and very brilliant results are obtained when the emulsion contains bromide and iodide of silver formed simultaneously.

It is also advised not to use an emulsion of high speed, as the dipping bath then tends to fog the plate. It is probable, in photographing colored objects, the bath plates will prove to be superior, as they will render more accurately the different shadings of colors in consequence of being more sensitive to yellow.

Removing Silver Stains.—Dr. H. W. Vogel recommends the same compound used as a reducer for removing stains of silver from the hands or clothes. A few crystals of ferricyanide of potassium are dissolved in a solution of hypo, or instead a 10 or 20 per cent solution of the ferricyanide is added to the hypo, and then applied to the stains. The advantage of this solution is that it is not poisonous, and does not destroy the color of articles of clothing.

Antwerp Prizes for America.

The juries at the Antwerp Exhibition made the following awards to American exhibitors:

Diploma of Honor.—Davis Sewing Machine Co.

Gold Medals.—Westinghouse Co., general machinery; New Home Sewing Machine; Geo. Bruce, Son & Co., paper ware.

Silver Medals.—Meriden Britannia Co., metal ware; Rochester Lamp Company; Santa Maria & Co., food products; Washington Packing Co.; San Jose Fruit Packing Co.; Arpad, Haraszthy & Co., liquors.

Bronze Medal.—Seabury & Johnson, chemicals.

Honorable Mention.—Leonard & Ellis, chemicals; Mr. Cooleman, chemicals; Lloyd & Suppler, tools.

Correspondence.

A "Gateway of Knowledge."

(FROM AN OLD SUBSCRIBER.)

To the Editor of the Scientific American:

My attention has been called to the fact that this is the fortieth year of the publication of the SCIENTIFIC AMERICAN. The first paper was published the year of my birth, in 1845; and I can say that I have been one of its readers for twenty years, or since I was twenty years old. I hesitate not to say that the SCIENTIFIC AMERICAN is one of the gateways to knowledge, and the SUPPLEMENT, its near relative, I have taken from its first edition. As journals of science, they have no equals. CHAS. MCCUNE.

Decatur, Macon County, Ill.,
November 16, 1885.

An Improved Thermometer Required.

To the Editor of the Scientific American:

One of the greatest aids in medicine is the clinical thermometer. As generally used, it consists of a glass tube having a bulb for the mercury, a construction in the bore between the bulb and main tube for maintaining the index, and a bar divided into degrees and tenths, the graduation running from 90° to 110°. The index is the important point. It is usually obtained by causing a portion of the mercury column to separate from the main column or from the mass of mercury in the bulb, so that it shall remain *in situ*, and register the degree of heat of the body after it is removed from contact with the body. Great trouble is experienced in maintaining this index, and many ingenious methods have been devised to overcome the annoyance of "losing the index" by constructing, turning, or twisting the bore of the tube. The bulb may be of various shapes, as an elongated cylinder, or even disk-shaped. The glass tube may be round, oval, hemispherical, or even triangular in section. The bore of the tube may be backed with white or black enamel, and the tube over the bore may be so made that it shall magnify the mercury.

With all its improvements, however, the material of which the thermometer is made remains the same, namely, glass—the great objection to which is its liability to breakage. In spite of hard rubber cases with shoulders, metal cases with chains, and other safeguards, thermometers will break. To enumerate the ways in which they may break would be useless; it is sufficient to say that they do break, and it becomes an item of no small expense to keep one's self in thermometers.

The one who can invent and put upon the market unbreakable thermometers will not only confer a great benefit upon the medical profession, but will enrich himself greatly. Such a thermometer must be accurate in measuring temperature and in recording it, and it must be permanent, that is, always record a given temperature correctly. It need not cover a scale of more than 20°, viz., 90° to 110°, but this scale must be divided into fifths at least, and tenths, if possible. The dial or scale must be of a size that can be easily read, or, if very small, must be magnified by a lens covering it. The whole thermometer must be of convenient size and shape. It may be a moderately long cylinder, 3 inches to 6 inches by ¼ inch to ½ inch, or a disk of moderate thickness and diameter, or an ovoid not larger than a robin's egg. The mechanism, including the dial, must be inclosed in a covering impermeable to moisture, and one that can be easily cleaned, preferably hard rubber. The different expansibilities of different metals would suggest one or more compound metallic bars, tubes, or plates, straight, curved, twisted, or coiled upon themselves or corrugated, one end being permanently fixed, the other being attached to an index in such a way that there shall be no loose motion, the sweep of the index being increased, if necessary, by suitable mechanism. Hard rubber may be used in connection with metal. The steam gauge and aneroid barometer are suggestive of a form.

These remarks are presented with the hope that some person may experiment in this direction.

CHAS. EVERETE WARREN, M.D.

No. 5 Union Park, Boston, Mass.

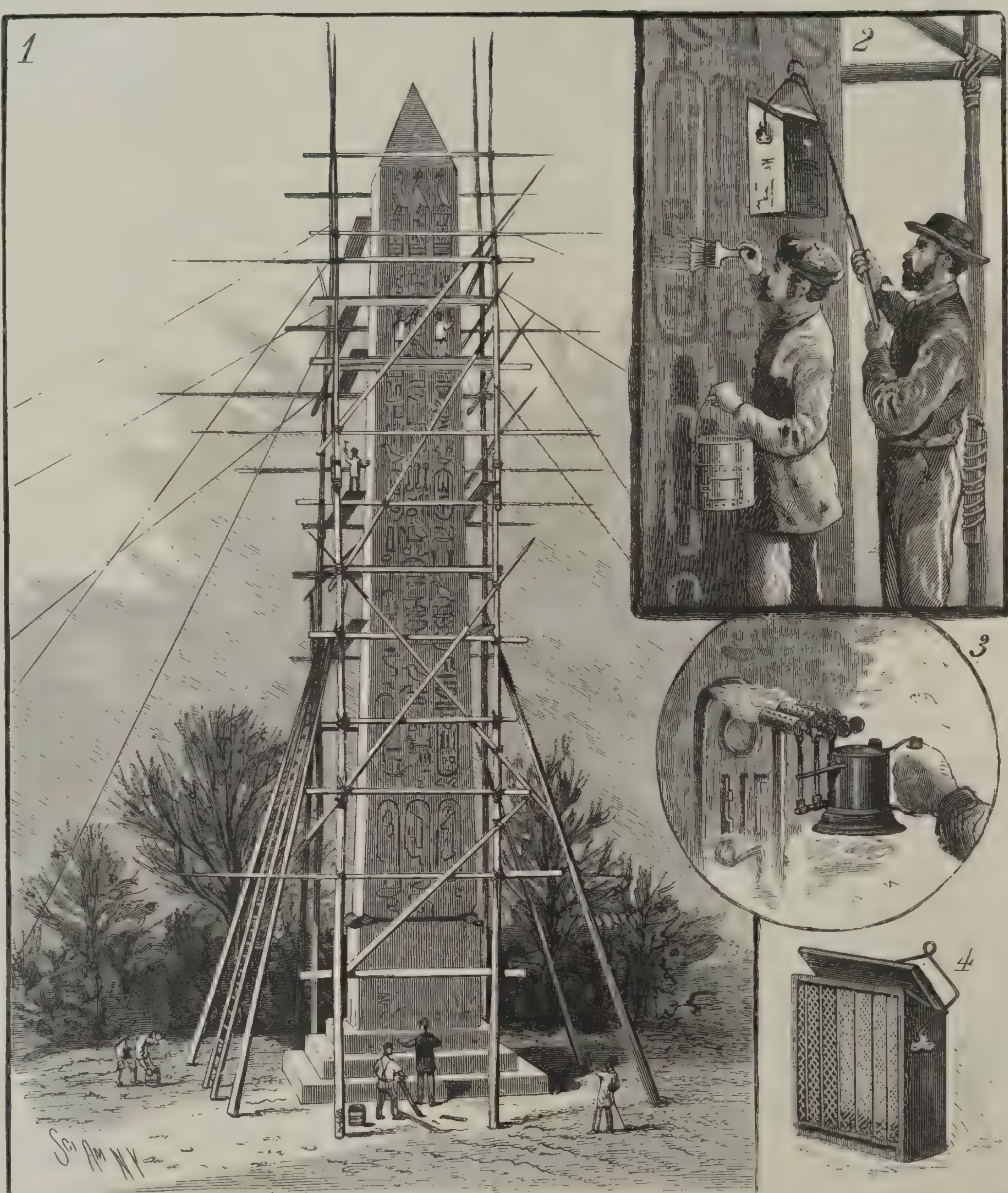
[The above is a good suggestion, which deserves the attention of our inventors. Some of the very volatile liquids, such as ether and gasolene, might be available in the construction of a thermometer of this kind. Such a liquid might be hermetically sealed in an elastic vessel, and the expansive force generated by the heat of the body acting on the liquid could be made to operate indicating or recording mechanism.]

Buckman's Car Coupler.

In our notice of the car coupler invented by Mr. Thomas E. Buckman, of Jacksonville, Fla., in the SCIENTIFIC AMERICAN of Nov. 21, it was stated that when the cars are drawn apart—having been uncoupled—the coupler always assumes "at the instant its position for *uncoupling* automatically." It is apparent that the word *recoupling* should have been used.

THE PRESERVATION OF THE OBELISK.

The work of preserving the Obelisk at Central Park, New York, has now been completed, and apparently none too soon, as the numerous storms which have since assailed the shaft would have done it material damage had the pores of the stone still remained open. The process employed was that described in our issue of Nov. 14, consisting of treating the heated stone with a mixture of paraffine, creosote, and turpentine, and has been applied by the Brick and Stone Waterproofing Co., of 55 Broadway, New York, who own the patents covering this treatment. As the manner of applying the process to a structure so tall and slight as the monolith attracted considerable attention, we have given somewhat detailed illustrations, showing respectively the general appearance of the shaft and scaffolding during the progress of the treatment, the process of heating the stone, the alcohol blowpipe used to penetrate the recesses of the hieroglyphics, and the construction of the charcoal furnaces. Now that the scaffolding is entirely removed, the stone shows to good advantage; and as it is a trifle darker in color, it resembles more perfectly the original syenite. The treatment has had the further effect of bringing out the characters into such strong relief that a number have been deceived into believing that they must have been recut. The process seems to have given entire satisfaction. It was, however, by no means experimental, as the company had already done much work in St. Louis, and during the past summer has treated a number of prominent buildings in New York, the white marble structure of the Mutual Life Insurance Company at the corner of Liberty Street being among the number. A severer test was that made at Newark, N. J., on the house of Mr. William Clark, the well known cotton thread manufacturer. The mansion is constructed of pressed brick and Wyoming blue stone, a small portion of which was treated two years ago. As the sample proved highly satisfactory, the entire building has recently been waterproofed. We also hear that the company has received a contract for treating all the stonework of Central Park.



THE PRESERVATION OF THE OBELISK.

The Montreal Cable Railway.

The cable railway or elevator by which the summit of Mount Royal, back of Montreal, is reached, has now been in successful operation for some days. The railway is 403 feet horizontal measurement, the height 275 feet, and the length of track 510 feet. It is built in a segment of a circle with a reversed side of twelve feet, and has an incline of about 33½ degrees. The road is supported by 16 iron pillars set in stone foundations, and the balances are of wood 12x12 inches. The gauge of the road is 5 feet, with a distance between the tracks of 4 feet. The cars are drawn to the top by means of a stationary engine of 75 horse power at the top of the mountain. The wire ropes are three in number, two of them being 1⅛ inches diameter and the middle one 1¼ inches. The two smaller ones have been tested with a strain of 35 tons, and the center or safety rope with a strain of 43 tons. The ropes pass over sheaves 6 feet in diameter, and are wound over two drums of wood and iron 10 feet in diameter, and are a direct pull upon the cars. The center or safety rope runs independently of the engine, and is attached to both cars, so that, in event of the two outside ropes breaking, the center one would hold the cars in check, besides which the large wheel of 11 feet diameter is provided with brakes, which may be applied from the platform at the top of the incline by the engineer. The fare on the incline is 5 cents up and 3 cents down.

ACCORDING to the *Deutsche Farber Zeitung*, the hardest indigo is easy to grind, dissolves better, and adheres better to the goods, if it is for 4 hours steeped in hot water with 1½ lb. calcined soda to 4 lb. indigo. When ground fine, 2 lb. soda and 16 lb. lime are added, and afterward 20 lb. pure copperas. The solution is made by heating in an iron boiler.

On Measurement.

Sir Joseph Whitworth asserts that the two great elements in mechanics are the power of measurement and the true plane.

The measuring machines which I have constructed, says Sir Joseph, are based upon the production of the true plane.

Measures of length are obtained either by line or end measurement.

The English standard yard is represented by two lines drawn across two gold studs sunk in a bronze bar about 38 inches long, the temperature being at 62° Fahr.

There is an insurmountable difficulty in converting line measure into end measure, and therefore it is most desirable for all standards of linear measure to be end measure.

Line measure depends on sight, aided by magnifying glasses; but the accuracy of end measure is due to the sense of touch, and the delicacy of that sense is indicated by means of a mechanical multiplier.

In the case of the workshop measuring machine, the divisions on the micrometer wheel represent 10,000ths of an inch. The screw has 20 threads to an inch, and the wheel is divided into 500, which multiplied by 20 gives for each division the 10,000th of an inch.

We find in practice that the movement of the fourth part of a division, being the 40,000th of an inch, is distinctly felt and gauged. In the case of the millionth machine, we introduce a feeling piece between one end of the bar to be measured and one end of the machine, and the movement of the micrometer wheel through one division, which is the millionth of an inch, is sufficient to cause the feeling piece to be suspended or to fall by its gravity.

The screw in the machine has 20 threads, which number multiplied by 200—the number of teeth in the screw wheel—gives for one turn of the micrometer wheel the 4,000th of an inch, which multiplied by 250—the number of divisions on the micrometer wheel—gives for each division one-millionth of an inch. The sides of this feeling piece are true planes parallel to each other, and the ends both of the bars and the machine are true planes parallel to each other, and at right angles to the axis of the bar; thus four true planes act in concert. In practice, we find that the temperature of the body exercises an important influence when dealing with such minute differences, and, practically, it is impossible to handle the pieces of metal without raising the temperature beyond 62°. I am of opinion that the proper temperature should be approaching that of the human body, and I propose that 85° Fahr. should be adopted, and that the standards and measuring appliances should be made and kept in a room at a uniform temperature of 85° Fahr.

In many workshops we hear the workmen speak in such vague terms as a bare sixteenth or full thirty-second, but minute and accurate measurement requires to be expressed in decimals of an inch.

In 1857, when president of the Institution of Mechanical Engineers, I read a paper on standard decimal measures of length, and I am happy to say that since that period the decimal system has been introduced to a certain extent in many engineers' works, but it is still far from being universal.

In the manufacture of our standard gauges, the workmen measure to the $\frac{1}{10000}$ of an inch, and these measures are as familiar and appreciable as those of larger dimensions.

As an illustration of the importance of very small differences of size, I have here cylindrical standards with a difference of the ten-thousandth of an inch. It is therefore obvious that a difference of $\frac{1}{10000}$ of an inch is an appreciable and important quantity.

It will be at once conceded that the only scale of measurement which can be used for such small differences must be a decimal one.

For many years the decimal system has been in use at our works, taking the inch as the unit, and the workmen think and speak in tenths, hundredths, and thousandths of an inch.

It is of great importance to the manufacturer to have the means of referring to an accurate fixed measure, as it will enable him, at any time, to reproduce a facsimile of what he has once made, and so preserve a system of the sizes of the fitting parts unaltered.

The great value of the workshop measuring machine is making difference gauges.

Every external diameter having to work in an internal diameter should have a certain difference of size; and close observation and experience can alone determine what this difference of size ought to be.

Take, for instance, a railway axle; if the bearing in which it has to work be too small, the heating of the axle by rapid rotation will be the consequence; if, on the other hand, the bearing be too large, it will be sooner worn out.

It is therefore most important, when rapid revolutions and great strains have to be undergone, that the proper difference of size, when once ascertained by experience, should be strictly adhered to.

In the manufacture of axles there should be two gauges used, the axle being made to the standard gauge and the bearing bored out to fit a difference gauge, which has to be as much larger as experience has found to be necessary, according to the conditions under which the axle has to work. Hence every manufacturer should be in a position to select his own difference gauges.

Fifty years ago the thousands of spindles in a cotton factory had each to be separately fitted into the bolster in which it had to work. At the present time all these spindles are made to gauge, and are interchangeable.

It cannot be impressed too forcibly, both upon the student in mechanics and upon the workman, that accuracy of measurement is essential for good and efficient workmanship, and that it tends to economy in all branches of manufacture, so as to have the parts interchangeable.

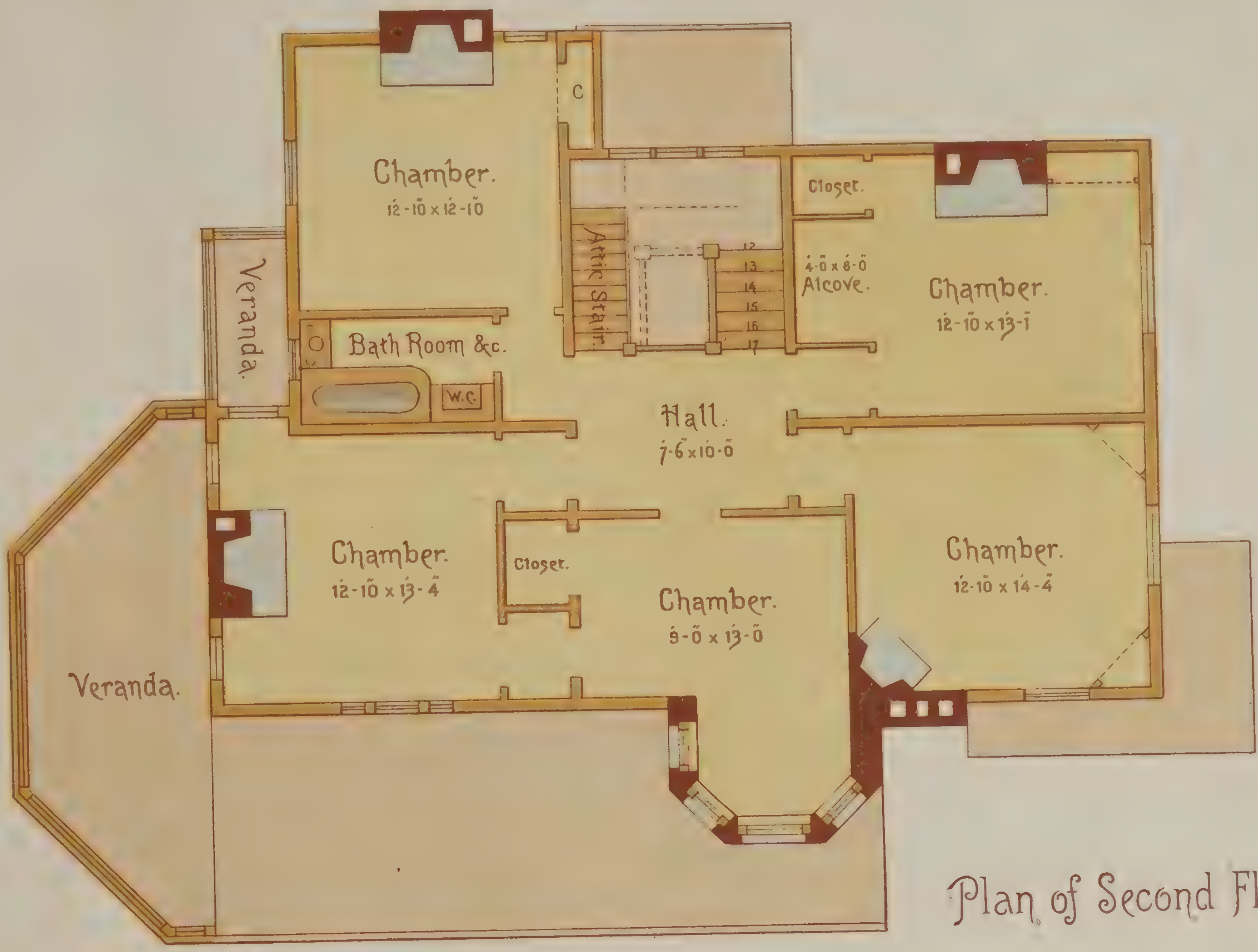
The Business Importance of Burglars.

W. S. Gilbert, in the London *Times*, says: "For my part, I could never quite understand the prejudice against burglars. An unarrested burglar gives employment to innumerable telegraph clerks, police officers, railway officials, and possibly also to surgeons, coroners, undertakers, and monument masons. As soon as he is in custody, the services of a whole army of solicitors, barristers, judges, grand and petty jurymen, reporters, governors of jails, and prison warders are called into requisition. Really, the burglar does more good than harm."

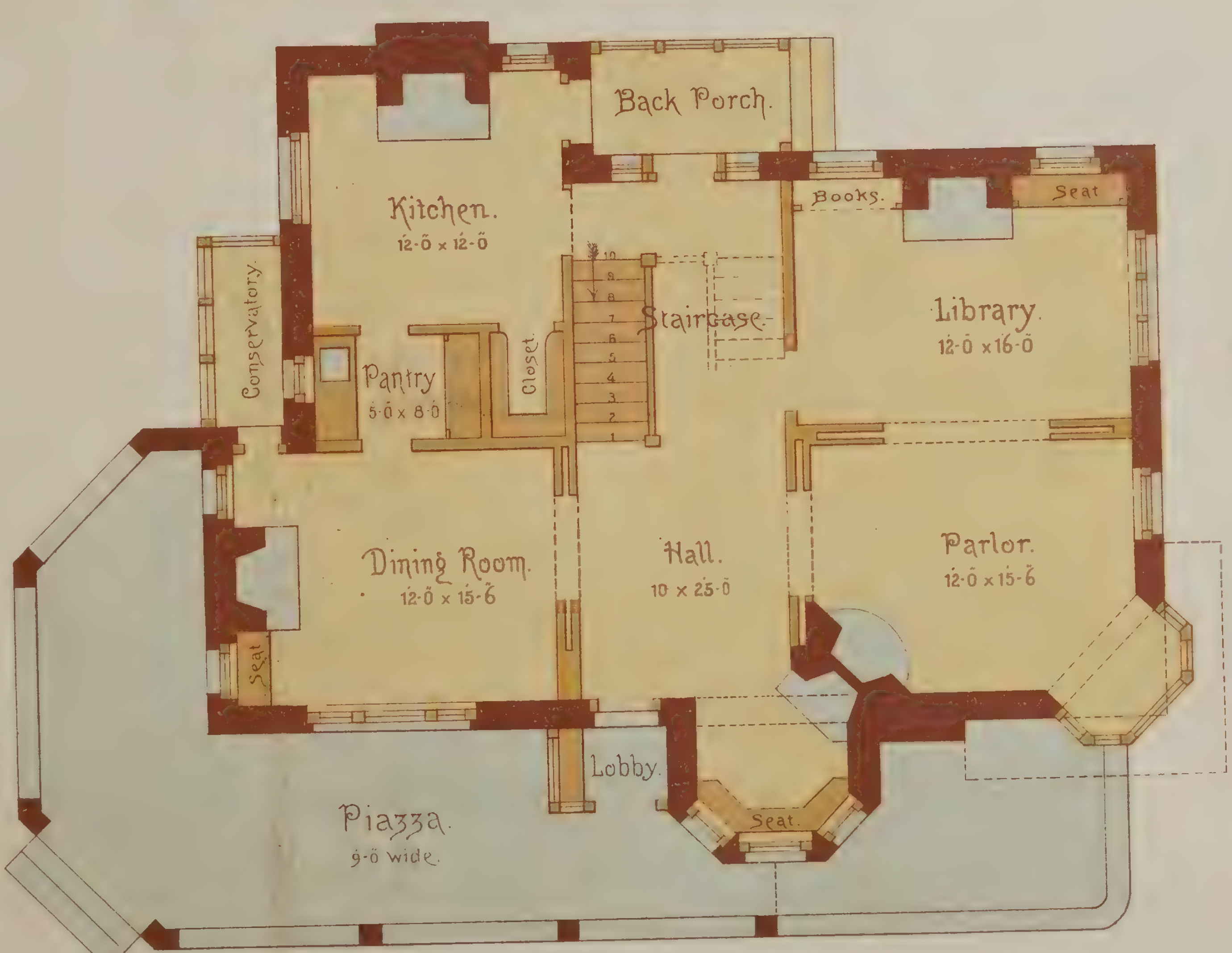
SIDE ELEVATION.

Design for a Country Residence. FRONT ELEVATION.

John E. Baker, Architect.
748 Broad Str. Newark, N.J



Plan of Second Floor.



Plan of First Floor.

Scale: 1/8 of 1 inch.

John E. Baker, Architect.
748 Broad Street.
Newark, New Jersey.

Design for a Country Residence.

SCHUMACHER & ETTLINGER, NEW YORK.

MONCRIEFF GUN CARRIAGES FOR RUSSIAN IRON CLADS.

Messrs. Easton and Anderson recently issued invitations to officers of Government manufacturing departments and foreign attaches to visit their works at Erith, in order to inspect the Moncrieff gun carriages made by them for the new Russian ironclad Catherine II. This vessel will probably have about 10,000 tons displacement. She is to carry six 50½ ton breech-loading guns in a central breastwork with steel plate protection overhead, somewhat resembling that adopted by the French in the Admiral Duperre and other barbette ships. The general form and position of the breastwork may be seen in Fig. 1. The guns are in pairs on turntables, and have a large scope of all-round fire. The breastwork only extends to a height of 22 inches above the surrounding deck, so that the battery is not conspicuous, and the guns but little exposed to view even when in their firing position. The breastwork consists of 12 inch compound plates made under Messrs. Cammell's direction in the new Russian factories, backed by about 12 inches of wood and a strong framework. The gun is very powerful. The projectile weighs 731 pounds, and the muzzle velocity is estimated at 1,950 feet per second. This gives 19,260 foot tons energy, with a perforation per inch circumference of 511·2 foot tons, which is equivalent to the perforation of about 23·7 inches of iron. The rule of thumb would give 23·4 inches, this being a case where the sectional density of the projectile is very high. The gun itself is made on the Krupp system. We do not ourselves, says the *Engineer*, like the section—a large heavy central tube is strengthened by several layers of short steel hoops over it. The whole of the longitudinal strain falls on the inner tube, which supports the wedge on the Krupp system.

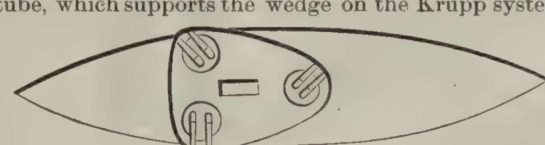


Fig. 1.

The individual steel tubes taper, and consequently their thickness from end to end varies, we think, too much. We believe that in future patterns the Russians contemplate the adoption of the interrupted screw breech in place of the Krupp wedge. Whatever may be thought of the details, however, the gun is very powerful, and the battery, of course, most formidable. As six ships are to be made nearly of the same type and power, the addition to the Russian navy is very important.

The following is a description of the parts shown as far as possible in Fig. 2.

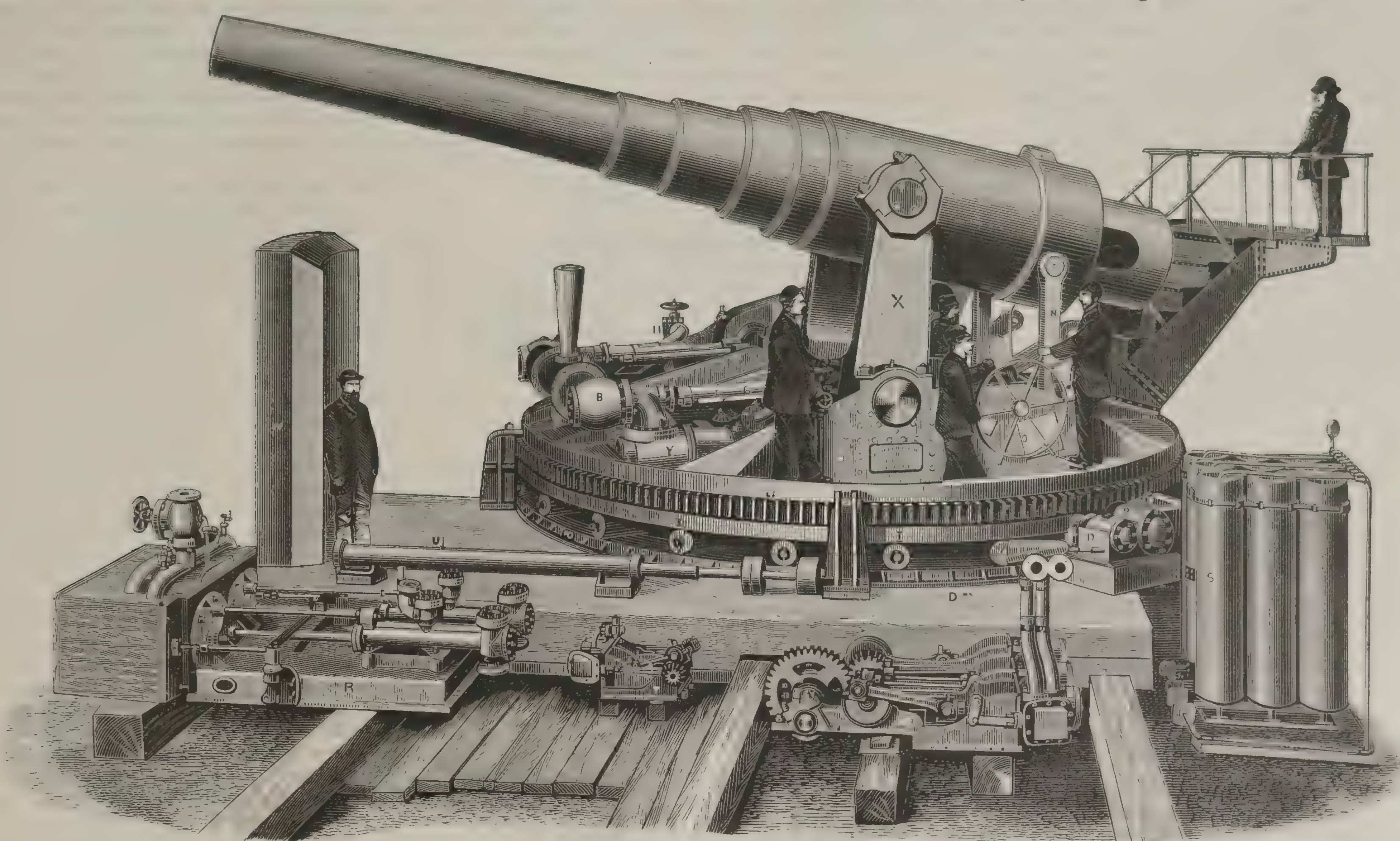


Fig 2.—MONCRIEFF GUN CARRIAGES FOR RUSSIAN IRONCLADS.

The mounting shown in Fig. 2 consists of a cast steel roller path, D, in segments 21 feet 9 inches—6·63 meters—diameter, secured to the main deck of the ship, upon which revolves upon twenty-two live rollers, III, and round a hollow steel central pivot, a platform composed of a cast steel ring, L, filled in with a thick wrought iron deck, to which, as well as to the outer ring, two pairs of gun carriage sides, J, are bolted and riveted. The carriage sides are hollow, and composed of pairs of steel plates riveted to steel distance pieces. Each pair of sides carries, in bearings fitted with cap squares, a rocking shaft, C, on which is secured a pair of levers, X, the upper ends of which are formed into the trunnion bearings for the gun, and are fitted with cap squares, while the lower ends of the levers have threaded through them a spindle, on to which is coupled a pair of connecting rods, the tail ends of which terminate in spherical ends, which abut against

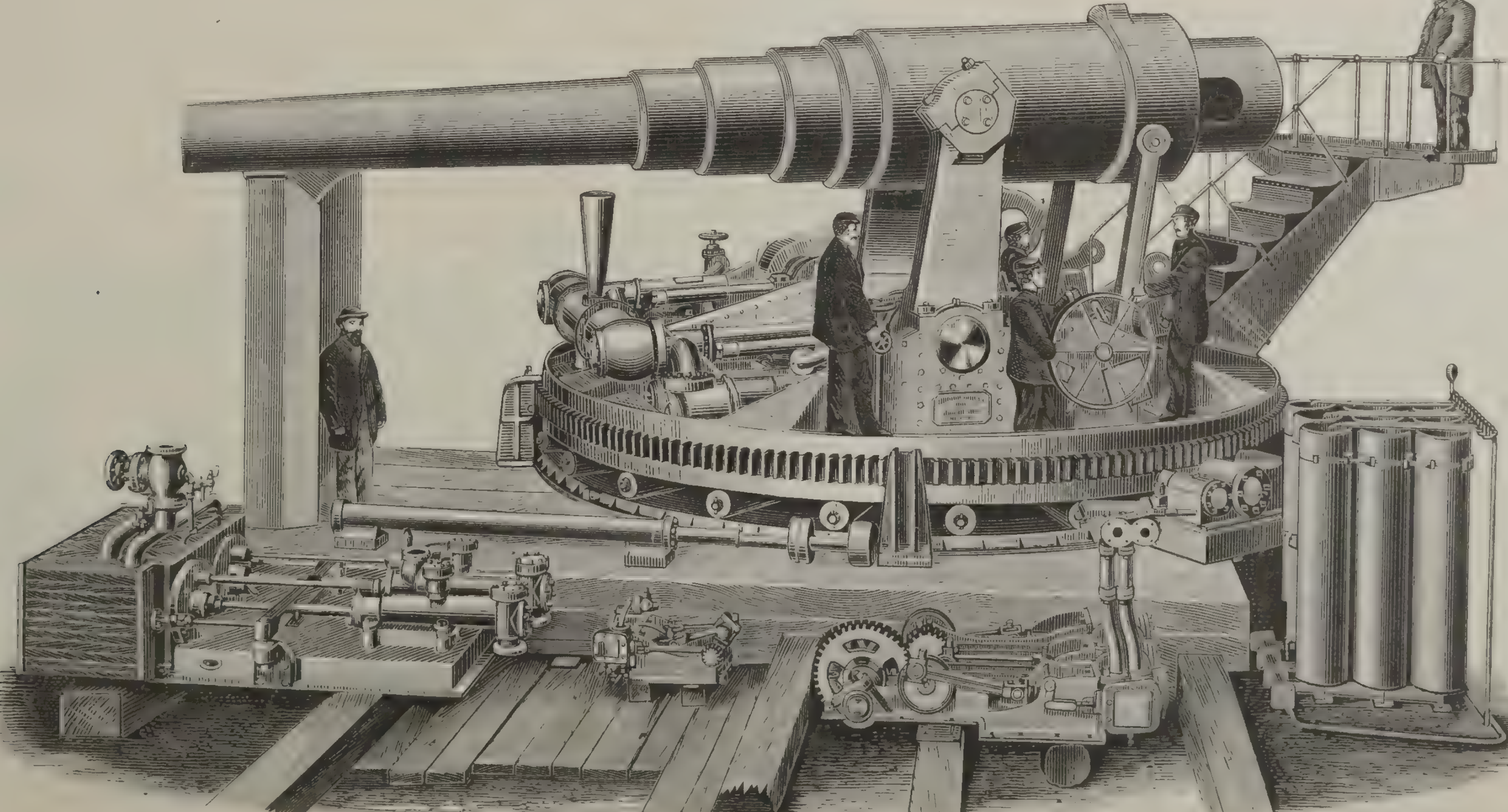


Fig. 3.—MONCRIEFF GUN CARRIAGES FOR RUSSIAN IRONCLADS.

the bottom of the steel hollow plungers, which work into the recoil cylinders. These cylinders, Y, are placed in the forward end of the carriage under the gun, and are secured by bolts and rivets to the carriage sides and to each other. To the upper forward end of each cylinder is fitted an escape pipe, A, which joins a recoil valve chest, B, common to each pair of cylinders. The recoil valve consists of an ordinary conical valve fitted with a strong steel spindle, which passes through a balancing cylinder and stuffing box toward the main rocking shaft, C, which carries the gun.

Inasmuch as the weight of the gun has more and more effect on the plungers as it falls, it is necessary to vary the load on the recoil valve, because a hydraulic pressure which would be sufficient to hold up the gun in any position will be too great to allow the gun to recoil down to the proper loading position. This adjustment is effected by loading the recoil valve by means of disk springs, E, threaded on its spindle and abutting on a crosshead, F, which is connected by means of a pair of tension rods with a cam movement on the main rocking shaft, the cams being so arranged that there is least tension on the springs when the gun is up, and most when it is quite down.

Gun Mounting on the Moncrieff Disappearing System, to mount two 12-inch breech-loading rifled guns of 50½ tons weight, for the Imperial Russian Navy. By Easton & Anderson, 3 Whitehall Place, London, and Erith Ironworks.

Caliber of gun	12 in.	305 mm.
Length over all	30 ft.	9.14 meters.
Weight	50·47 tons	51,271 kilos.
Weight of shot	731 lb.	331·5 kilos.
Weight of powder	248 lb.	112·4 kilos.
Muzzle velocity	1,950 ft.	591·3 meters.
Weight of carriage	100 tons.	101,134 kilos.
Fall of g n	4 ft.	1·22 meters.
Diameter of turrets	35 ft. 6 in.	10·82 meters.
Height of turret	9 ft.	2·74 meters.

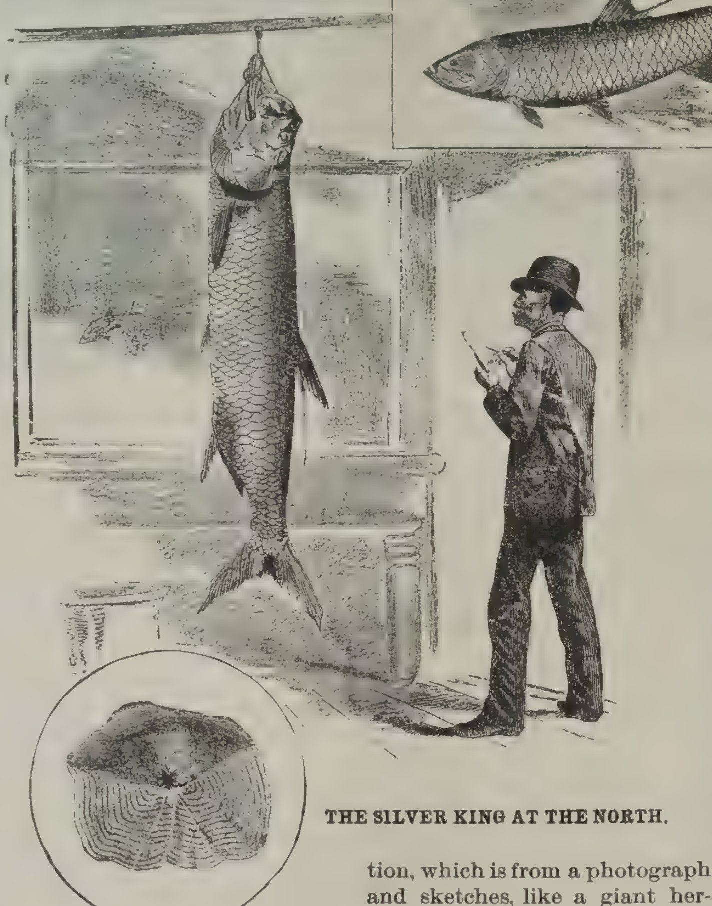
The outer end of the valve spindle is screwed, and carries a disk and pair of nuts, by means of which any desired initial tension may be placed on the springs. The pressure in the recoil cylinders during discharge is expected to vary between 48 atmospheres and 55 atmospheres. The water from the recoil valves is discharged into a large cast iron pipe common to both pairs of cylinders, by means of which it is conveyed into the central pivot casting, and so back into the tank from which the pressure pumps draw their water. For raising the guns, water, under about 66 atmospheres pressure, is admitted to the rear and upper end of the cylinders, that is, the ends nearest the center of the carriage, by means of a stop valve controlled from the side of the carriage. The plungers do not fit their cylinders fully, but terminate in pistons of a little larger diameter, through which there are holes which always keep up a free waterway between the forward end of the cylinders and the annular space to the rear of the pistons.

The pipes, H H, by which the water for raising the gun enters, communicate with the cylinders close to their glands, the water makes its way freely through the pistons to the forward end until the pistons reach the opening of the pipes, and then, as the gun rises further, the pistons gradually close the opening, and thus by throttling the water bring the gun gradually to rest in its firing position. The guns can be lowered slowly by letting the water escape from the cylinders through a small screw stop valve placed beside the main lifting valve, the water in this case also returning to the pump tank. The rotation of the gun platform is effected by means of teeth, L, cast in the upper roller path which forms the frame of the platform. Into these teeth gears a cast steel pinion keyed on a vertical shaft, which descends through the main deck to that beneath, M, where it is actuated by a double-acting three-cylinder engine, the movement of which can be controlled through the center pivot by means of a system of rods and levers worked by hydraulic notch hand gear placed between the pair of guns. The elevation of the guns is accomplished by elevating bars, N, attached at their upper ends to trunnions formed on the rear ends of the guns, and at their lower ends to screw lifting gear contrived in the hollow carriage sides about O, and so adjusted in form and disposition that the guns always recoil into the same loading position, whatever the elevation may be. The gun platform is prevented from turning excessively from the discharge of a single gun by means of a brake, P, worked by hydraulic pressure, and it is locked in the loading position by a bolt, which is shot by the same agency; the application both of the brake and of the bolt is performed automatically by the hydraulic hand gear for rotating the platform.

Hydraulic pressure is supplied by means of a direct-acting automatic duplex pumping engine, R, capable of delivering 20 cubic feet per minute under a pressure of 66 atmospheres; this pump may be placed in any convenient position in the ship. The water under pressure is pumped into an air accumulator, S, composed of nine steel vessels grouped together, and of a capacity sufficient to raise both guns once into the firing position without the assistance of the pump. The compressed air in the accumulator is supplied by a small torpedo air compressing pump. The ammunition is served by means of an inclined endless chain actuated by small steam engines, T, and is rammed home by means of telescopic hydraulic rammers, U; the sighting platform may be seen at V, and a piece of barbette wall at W.

THE SILVER KING IN NORTHERN WATERS.

A tarpon (*Megalops thrissoides*), or silver king, as it is often called, measuring 5 feet 9 inches, and weighing, when taken, 110 pounds, was caught last Monday (August 17) in a seine by a fisherman off Sea Bright, New Jersey, and exhibited at the stall of Eugene Blackford, the fish commissioner. This fish, though rarely taken in Northern waters, is very abundant about the coasts of Florida and throughout the Gulf of Mexico, and deserves to be better known. It looks, as may be seen in the illustration, which is from a photograph and sketches, like a giant herring, as is indicated by one of its popular names, "The king of the herring." A spine projecting back of the dorsal fin measures 12 inches in length, and looks like a terrible weapon of offense or defense, though there is no account of its being used as such. One peculiarity of this beautiful fish is its large and brilliant scales, measuring on an average over three inches across, covered with a luster that resembles silver, and in part somewhat translucent, showing beautiful red markings, when fresh and held against the light, like thin cowry shells. They are used in Florida in the manufacture of artificial jewelry.



THE SILVER KING AT THE NORTH.

If required to name the best North American game fish, the one whose capture is accompanied with the greatest amount of pleasurable excitement, the one requiring the greatest amount of skilled and practiced muscle on the part of its captors, I would unhesitatingly give preference to the silver king; multiply the vigorous resistance of a 24 pound salmon by five or six, or a large bluefish by a multiple twice as great, and you have some idea of the difficulty of landing a full grown silver king. A fish takes your bait with a rush. If inexperienced in tarpon, your finger is cut to the bone. The line fairly whistles as it leaves the spinning reel. It all runs out, parts at its weakest point, and the fish carries your tackle out to sea. Many are hooked, but very few caught.

There is, or was, I believe, a standing offer to pay for an excursion ticket to Florida and three months' expenses to any one who would land a tarpon with rod and reel, so difficult is the taking of this fish; and yet that the difficulties of thus catching them are not insurmountable may be seen from the account published in the SCIENTIFIC AMERICAN of May 23, 1885, of a specimen weighing 93 pounds, having been taken on a 21 thread line and 5 foot bamboo rod.

The experience of Mr. W. H. Wood can be had by any skilled fisherman with suitable tackle. At present, tarpon fishing is scarcely known as a sport, and the best means and appliances for taking the fish are scarcely determined. The inside of the mouth is very tough and elastic, and the fish seems to possess the power of ejecting the bait by protruding its fleshy tongue. The upper jaw is armed with minute teeth; and consisting, as it does, of movable plates working against the upward pointing lower jaw, invariably cuts the line, which necessitates the use of plain wire, to which the hooks are soldered, or some such device to secure a hold. A writer in the *American Angler* for Dec. 15, 1883, recommends the following barbarous and possibly unsportsmanlike rig for the capture of this noble fish:

"I take the heaviest piano wire obtainable, and make three joints four inches long and three six inches in length. The joints of the links are made by heating the wire in the fire, bending each end, allowing half an inch for soldering. Before soldering, I polish each piece of wire with emery paper, and tin it to prevent rusting. To the upper link I attach a strong brass swivel, two and a half inches long. I wrap the ends of the wire below the loops with fine copper wire, and finish the job with common solder. I use hooks two inches from tip to shank. To each of the three lower links I solder two hooks at a right angle. When completed, the hooks are in two lines. For bait, I cut a mullet in half from mouth to tail. I pass one hook through the eye, one amidships, and the other near the tail. Three hooks pass through the bait with points exposed, and the three others pass beyond the edge of the bait. In addition, I take a packing needle and fine twine, and tie the links to the bait. By adopting this course I make an attraction, and armed with hooks partially concealed and an almost invisible snood. Tackle rigged in this way possesses great strength, for the last time I was fishing at Mayport, I captured two sharks, one seven and the other nine feet in length, with my tarpon rig."

To give some idea of the almost resistless power of this fish in making "a rush," the story is told of a party of gentlemen, among whom was a lad fourteen years old, who were fishing in the surf at Pelican Island. To secure his line, the boy had tied it about his waist; whirling his weighted hook about his head, he threw it as far as he could out to sea. In a moment his bait was taken, and in another the screaming, struggling boy was dragged into the surf, from which he was with difficulty rescued by his companions. The fish had caught the boy.

HOW TO MAKE WINTER EVENINGS PROFITABLE

This is the season of short days and long evenings, the best time of all the year for study and improvement.

Perhaps you are a young man desirous of obtaining commercial employment. One of the best passports in that direction, next to good character, is good hand-writing. Of course, you know how to write, but like the great majority, probably, you have never trained yourself to write well. No merchant wants his books disfigured by awkward and illegible scrawling. No lawyer will submit to badly written copies. We suggest you devote yourself this winter to persevering endeavors to improve your penmanship. You will be surprised at the improvement which real effort in this line will achieve.

May be you would like to learn stenography and type writing. The faithful employment of your winter evenings in this work may make you a first-class graduate before the long days come again, and enable you to earn a handsome support.

Do you wish to become expert as a mechanical draughtsman? There are excellent instruction books, sold very cheaply. The industrious occupation of your evening hours as a learner will surely be fruitful of results. We know of excellent draughtsmen, now enjoying good salaries, who taught themselves to draw in evening hours, while companions idled away their time in smoking, cards, or gossip.

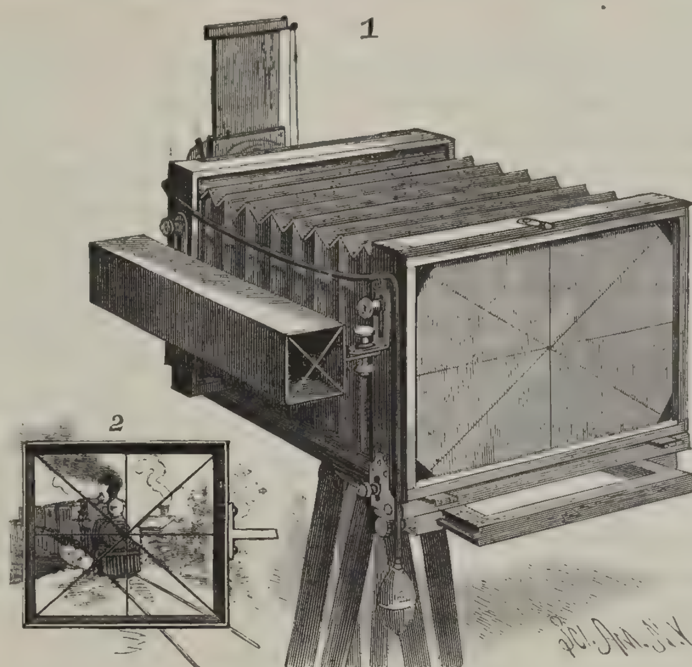
Are you of an inventive turn of mind? The best of all times to study up and think out plans for new contrivances is in the quietude of evening. The results of earnest thought in the production of inventions are simply astonishing. In general, it is the improvements in simple devices, things of everyday use and that everybody wants, which are the most profitable. The patent for the little invention of the spring window shade roller, now so generally employed in all dwellings, has brought great wealth to the fortunate inventor. He is now a millionaire. His device was truly a happy thought. We know of a lady in Chicago whose patent for the inventions of a moving belt for drying eggs, albumen, etc., have revolutionized certain great branches of trade, and now bring her a great income. The people want improvements in every conceivable form. Not only is the field of invention vast, but it is open to everybody. There are no distinctions in respect to sex or age. The way to invent is to "keep thinking;" the way to accomplish anything is to "keep working."

PHOTOGRAPHIC CAMERA FOR INSTANTANEOUS VIEWS.

The purpose of this camera is to place the object to be taken with unerring certainty in the center of the sensitive plate, and by it the operator is enabled to take pictures with increased facility while holding the camera in the hand, or even while walking. With a camera so fitted and provided with a drop shutter, pictures of moving animals and groups of people may be readily taken, the pictures being free from stiffness and true to life. The drop shutter of the instrument may have the usual spring handle, but instead of being released by a touch of the finger, which necessitates reaching the hand in front as far as the lens, it may be released by a pneumatic attachment connected by a rubber tube to a rubber bulb at the back of the instrument (as shown) within convenient reach of one hand. Pressure on the bulb instantly operates a piston which releases the shutter. The drop shutter may also be so constructed as to be operated by a slight pull on a string extending to the rear of the camera.

The attachment forming the main subject of this invention, which has been recently patented by Mr. Henry Correja, of 25 Avenue de Villiers, Paris, France, consists of a tube having, preferably, a square transverse section, and having such length, proportioned to the camera on one side of which it is arranged, as to protrude at both its ends through holes in the black cloth usually used on the camera. The forward end of the tube, near the lens of the camera, has cross hairs arranged a little distance within it. One of the cross hairs, which are narrow strips of metal or other material, is placed in a vertical and the other in a horizontal position, so that they divide the "field" in the tube into four equal parts. The back end of the tube is also divided into four equal parts by cross hairs arranged diagonally in relation to the tube. The inventor terms this tube the "finder." To one of its sides are secured two slotted bars arranged at suitable distance apart according to the size of the camera, while in grooves opposite them and connected with the camera are two other bars having corresponding slots; these bars slide up and down, and are secured by binding screws. Marked upon the ground glass of the camera are lines corresponding in arrangement with the cross hairs in the tube.

Before proceeding to take an instantaneous photograph, the object is focused on the ground glass in the camera in the usual way. The operator then looks through the finder and moves it sidewise at either end, or up and down, by means of the slotted bars until the cross hairs occupy the same relation to the object focused as the pencil marks on the ground glass did. The tube is then locked in position by means of the binding screws, and the instrument is ready for use. After the object to be photographed has been properly placed in the field of the tube by the aid of the cross hairs, the operator releases the shutter with one hand while he carries the camera by its shut legs with the other hand. That the object will be properly placed on the sensitive plate with absolute certainty is evident from the fact that after the finder has been adjusted, the object will occupy the same relative position on the plate that it had in the field of the finder.



PHOTOGRAPHIC CAMERA FOR INSTANTANEOUS VIEWS.

HOFFMANN'S NEW PLAN FOR A CEMETERY.

The question of cemeteries is one of very great importance, especially in large cities, and an unlimited number of moral, religious, sanitary, social, physical, and financial points must be considered. Cremation solves the problem, but prejudices prevent its early adoption.

A well known artist, Joseph Hoffmann, has designed a new cemetery, which is, no doubt, original. Its practical execution is very doubtful, but, nevertheless, the plan is of sufficient interest to be worthy of notice Mr. Hoffmann does not intend to bury the corpses, but to place them in a gigantic mausoleum of sufficient size to receive many hundred thousand bodies. Each body is to be placed in a separate compartment, which is hermetically closed. The cells or compartments are each to be about 7 feet long, 3 feet wide, and 3 feet high, and are lined on the inside with glazed tiles, so that no infectious liquids, etc., can be absorbed by the masonry. The general shape of the mausoleum is that of a pyramid surrounded by smaller pyramids, pavilions, arcades, etc.

In the annexed cut, taken from the *Illustrirte Zeitung*, one of Mr. Hoffmann's designs is shown. This represents a structure of enormous magnitude, and as the entire building, from the foundation to the top, is honeycombed, or built with cavities, it is evident that a large number of bodies can be entombed therein. The cells are to be so cheap that even the poorest can have his own cell, and his bones need not be disturbed after a certain number of years, as is customary now in our cemeteries.

Phosphoric Acid from Slag.

Herr Blum, at Alzette, in Luxemburg, has a process for utilizing the phosphoric acid from the basic Bessemer process. Instead of adding lime to the iron during the blow, he adds carbonate of soda free from sulphur. This is introduced into the converter in a melted state, in the proportion of 5·13 parts to every one part of phosphorus, and 7·85 parts to every one part of silicon; then the pig iron is run in and blown as usual, when the slag is tipped out into an iron wagon. This slag contains phosphate and silicate of soda, and according to the nature of the lining it also contains more or less iron, manganese, lime, magnesia, and sulphur.

It may be used at once direct as a manure; or it may be treated first with cold water to extract phosphate of soda, which has a market for many purposes, after which silicate of soda may be extracted by hot water and used for making water glass, and the metallic residue may be used for making ferromanganese.

A pamphlet by the inventor undertakes to show that the process can be worked at a profit. At Creusot, in order to save carbonate of soda lime is added.

DESIGN FOR A CEMETERY, BY HOFFMANN, VIENNA.

TO THE READER.

The blue mark signifies that this copy of our paper is sent only as a specimen. If you desire its regular continuance for the year, please send us your address and remit *one dollar and fifty cents*. *In clubs*, four copies, one year, $5; same rate for more than four copies.

We expect to continue the issue of the colored plates and sheets of details with every number. They alone are worth more than the yearly subscription price.

Elegant colored plates are now in preparation for succeeding issues.

The first number of this edition was printed in November last. We can, at present, supply to new subscribers copies of the first number, thus enabling them to secure all the colored plates and sheets of details from the beginning.

In sending subscriptions, if the back numbers are desired, write "Begin with No. 1."

Please show this copy to friends, and if possible send us a club of four or more names. Each paper will be separately addressed, and sent as ordered.

For Christmas and New Year's what could be more appropriate or pleasing, as a present to husband, son, nephew, cousin, or friend, than a year's subscription to this excellent work?

The beautiful style of the publication, its elegant illustrations, the varied, interesting, and useful nature of its contents, combine to make it desirable to every one.

MUNN & CO., Publishers,
361 BROADWAY, NEW YORK.

☞Single copies, 15 cents Sold by all newsdealers.

OUR FIRST NUMBER.

The first number of the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN was issued November 1, 1885. Its contents are of much interest and value, as will be seen from the table given below.

It is accompanied by two supplements, consisting of two plates in colors, illustrating a country residence, by O. P. Hatfield, architect, and a large sheet of details pertaining to the same. The November number is further illustrated by fifty choice engravings.

TABLE OF CONTENTS

Of the November number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked *.)

OUR DECEMBER NUMBER.

Presented herewith, it speaks for itself. With it we send two large supplements, one of which comprises colored plates illustrating a beautiful and attractive country residence by Mr. John E. Baker, the well known architect of Newark, N. J. The other supplement consists of a large sheet of details of the same.

The number is further illustrated by a variety of engravings, and many subjects of interest are given. Young people will be interested in the illustration of skate sailing on page 51 and in the sailing merry-go-round on page 50. The engravings and descriptions show how these devices are constructed, and they may be made easily by any one.

On page 52 is shown a fine view of the great Temple of Diana, as restored by James Fergusson, F.R.S.

For the entire table of contents of the December number see page 34.

OUR JANUARY NUMBER.

We have in preparation for issue in the January number a series of most interesting articles, illustrated with many choice engravings.

The colored plate for January will illustrate the block of elegant city residences lately erected in this city on West End Avenue by Messrs. Lamb & Rich, architects. The colored plate shows the avenue front of the block, consisting of five houses; another plate, not colored, shows the fronts of five adjacent houses on Seventy-third Street. These fronts are of various designs and various sizes—very beautiful and attractive; they illustrate the most recent plans and designs for city dwellings of moderate size and cost.

The houses vary in size from fronts of 16 feet 8 inches to 30 feet.

A large sheet of details will accompany these plates, in which the plans of the various floors will be given.

Our January number will be one of great interest and value.

THE TOMB OF GEN. GRANT.

Almost the last wish expressed by the great hero was that his remains might be entombed in New York, "because the people of that city befriended me in my need." He had in mind, no doubt, the generous fund of a quarter of a million dollars, which some of the generous citizens had presented him as a souvenir of their appreciation of his noble deeds. Except this fund, all he had in the world has been swept away by a resistless tide of misfortune.

The chosen place for the tomb of the General is Riverside Park, which is situated in the central part of the great city, on its western border, overlooking the Hudson River, whose placid waters here broaden into a lovely lake. The park is about three miles long, and is one of the most charming places in the world. Gen. Grant's remains now rest in a temporary vault in the northerly part of the park. Near by is a camp of Union soldiers, who guard the sacred remains of the patriot commander. Here a magnificent monumental tomb will be erected, to receive his body, and by his side, in accordance with his wish, his beloved wife will be buried on her decease.

The park begins at 72d St., where it is directly connected by a broad avenue with Central Park, distant half a mile.

Following the park to the north, the ground gradually rises, until at 124th St. it has an elevation of 135 ft. above the river. This is known as Claremont, and has been chosen as the site of the monument. On the opposite shore, the trap rock of the Palisades rises from the river and makes a graceful outline against the horizon.

A short distance above the park are Fort Lee and Fort Washington, with whose names and localities are associated many heroic memories of our national glory.

The illustrations show some of the features of Riverside. The lower portion of the picture is a view from the bluff at 90th St. looking toward the north. The central and upper cuts represent different views in the park as one approaches Claremont. The small engraving on the right gives a glimpse of Claremont taken a few steps in front of the spot chosen for the tomb.

INTENDED LOCATION OF GRANT'S MONUMENT.

RIVERSIDE PARK, NEW YORK.—THE BURIAL PLACE OF GENERAL GRANT.

DESIGN FOR A COUNTRY RESIDENCE.*

TO COST $6,300.—FIRST STORY STONE.

[Illustrated by two colored plates, with sheet of details.]

BY JOHN E. BAKER, ARCHITECT, NO. 748 BROAD STREET, NEWARK, N.J.

General Observations:

"That a house may be beautiful, it must be interesting. That a house may be interesting, it must have character." This is the keynote to all designs, whether it is a house or stable; but I would add, it must be practical. How near I have arrived at this, I will leave for the reader to judge. I have aimed at boldness and simplicity, and perhaps it may not be "fancy" enough for some who are accustomed to the highly flavored "Queen Anne," so called for want of a better name: but I think the time will arrive (if it has not already) when the American people will discard this style of architecture, both from an artistic and practical point of view. There is nothing artistic in a heap of pediments, dormer windows, and balconies arranged without any thought of the principle of design, but, it seems, with the only idea of getting all the good features in one design that the designer had in stock; and as for being practical for our climate, needs no argument. The accompanying house has a look of solidity, as though it was chiseled out of a solid mass; some may object to the stone porches as having a tendency to darken the rooms, but this is obviated by making the windows large. The first story is designed to be laid up with rough stone, either brown or blue stone, random or broken ashlar, rock face, laid in cement mortar, struck joints; in some cases I have used red joints, but is not here recommended, as nothing is more artistic and practical than to see the real old stonework. If desired, the windows and corners of the building could be trimmed with brick laid in red joints. The happiest effect is obtained by using the ordinary field stone, as they have a variety of colors; warm browns and cool grays are here mingled together, producing a soft and artistic effect, which cannot be obtained with either blue or brown stone. I am now using a light blue stone for three houses at Orange, N. J., taken from the "Nevins" quarry on the Orange Mountain; they are lighter in color, and do not have that dark and cold effect that most blue stone produces.

The roof is of shingles stained dark red. The octagon tower and belt around building is also of shingles. The second story is inclosed with clapboards. The rear bed room over library could be made larger, removing the closet and partitions forming alcove, which I think would be desirable. A great deal depends upon the location of this house. The dining room should have an eastern exposure if possible. This should be the pleasantest room in our homes; it should have the morning sun; it is the best tonic that can be taken before breakfast, and surely it will make us cheerful and help to digest our food. More mistakes are made by people in locating their houses than can be imagined. Brown looks over Smith's house, and thinks it just what he wants. He orders his builders to build him one "just like it," and does not for a moment stop to think about the location. The hall is one of the oldest features which we have taken from the primitive house. In the grand old castles and the early English homes the hall was made the dining hall, parlor, sitting room, library, and kitchen, and sometimes the bed room, as the occasion required. Screens were made to divide the rooms instead of stationary partition walls; this in some respect was very convenient, especially when the city relatives of a noble lord made a raid upon him during the summer months, a few extra rooms could be added without any extra expense. But as civilization has advanced, the "hall" gradually dwindled down to a long, narrow, and dark passageway, where we have been accustomed to run the gantlet, as it were, to get to a more cheerful place, where we could find rest after a long and tiresome journey.

The hall, as shown by the plan, is large and broad; it runs through the entire depth of the house, measuring 10 feet by 25 feet, exclusive of the cozy corner, which takes in the large, open, brick fireplace. The hall is made the feature of the house, as all halls should. The position is central, and dominates the dwelling; it is virtually the "heart" of the house. A house with a large hall would give us the impression that the owner was a large hearted man. It would have an inviting and hospitable look; access to all rooms is obtained without passing through the other apartments; an exit is obtained in the rear under the stair balcony, opening on to the back porch, thereby obtaining a view of the garden. The kitchen outside entrance is shown on the same porch, but with a little extra expense a separate entrance could be obtained to the kitchen, which would be advisable, and the rear porch could be extended out to the end of library wall, and there connect with a "porte cochere." The cellar stairs are under the main stairs, thereby gaining access to the cellar from the hall; the same stairs also can be used from the kitchen; two doors answer to shut off the hall from the kitchen. The main stairs have a large balcony, which is 7 feet from the hall floor, and extends across the entire width of hall. This would be an excellent place for an organ, or fitted up with a seat; and with a little extra expense the conservatory could be built over the back porch, and made to open on to this balcony; the effect from both the lower and upper halls would be charming. The plan is designed here to have a large stained glass window on the balcony, not with strong reds, blues, and greens, but with dark and rich colors, which throw a soft and subdued light through the railing of the stairs. Stand in this hall. What vistas you obtain! The grand staircase before you; at your right, through the half open door, we catch a view of the library fireplace, with the blaze of the fire reflecting on the tiles and brass work; then another opening the dining room fireplace, and a glimpse of the flowers in the conservatory. The parlor, opening into the library, the cozy corner at the right, with its brick fireplace, tile floor, and the high back seat, where the children are assembled, watching the burning of the "yule log," and—hark! the old organ on the balcony peals forth a Christmas carol, the children stop their merry making and mingle their sweet voices with accompanying music. Can a more pleasant picture than this be imagined? The floor of the hall should be plain oak, with a simple border if desired; inlaid floors with their geometrics are not wanted here; we do not want to solve their Chinese puzzles. The floor should be flat; this is no place for perspective; a hall rug that is bright and cheerful is what is wanted here. High polished floors should be avoided; an old Oriental lamp should hang from the center of the timbered ceiling; and an oak chest with iron bound hinges; but I must stop here, as space will not allow me to describe the decorations and interior work, but I will in a future number give a full description how to furnish and decorate this house, with sketches of them, which will probably be in color.

* Mr. Baker will be happy to answer any questions or give any information that may be desired by our readers, and he is prepared to furnish working drawings and specifications and full size details, and superintend the erection of this house. We will in a future number publish the interior views of this house, with suggestions for decorating.

SPECIFICATIONS.

Excavating:

Do all excavating necessary for cellar, trenches, piers, privy vault, cesspool, etc. Earth graded about building. Cart away mason's rubbish. Excavated material graded around the premises. Outside of foundations cemented.

Foundations:

Start stone walls 6 in. below cellar bottom, and carry up same to second story beams 18 in. thick, with good quarry stone, laid in cement and sand mortar, plastered outside one coat cement mortar. Build area wall up to grade, same thickness. Put down foundations under piers, 2½ ft. deep of concrete. First story laid up with good, sound, brownstone random or broken ashlar, rock face.

Brick Work:

Build up chimneys with fire places and flues as shown, joints in flues and kitchen fireplaces struck. Turn arch over kitchen fireplace, and trimmer arches to all fireplaces. Put in three earthenware stovepipe collars with tin covers. All brick work to be laid up with hard Jersey brick in cement and sand mortar. Partition walls in cellar of brick 8 in. thick.

Drains:

Lay 4 in. vitrified earthen drains from house to cesspool, situated 30 ft. from rear of building, also from leaders to gutter, all joints thoroughly cemented, to be laid 2 ft. below grade. All pipes to be submitted to architect before being covered. Also lay 6 in. drain from leaders to cistern as shown on plans.

Bluestone:

First story and cellar window sills 3 in. thick, cesspool flag 2 ft. × 2 ft., chimney caps 2½ inches thick, kitchen hearth 1·6 × 4·0. The above to be of sound blue quarry-dressed stone. Area steps 10 in. wide, set with brick risers. Coping on area walls bedded in cement. Cellar piers to have bluestone caps 3 in. thick size of piers.

Cellar Bottom:

To be leveled off and concreted 3 in. thick with cement, sand, and gravel, floated off on top.

Lathing:

All lath used must be the best St. John spruce lath, laid ¼ in. apart, with 4 nailings to the lath and joints broken every 18 in., no lath put on vertically. Back of all chimneys to be lathed and plastered.

Plastering:

All walls and ceilings in 1st, 2d, and 3d stories to be plastered three-coat work in the best manner, closets and attic one coat and skimmed. Cellar ceiling to be lathed, and plastered one heavy coat plaster. All plaster to extend down to the floor. Scratch and brown coats composed of clean, sharp sand, goat hair, and lime. Lime run through sieve, hard finish composed of lump finishing lime, plaster, and white sand. All walls, ceilings, and angles to be perfectly straight, true, and level, browning kept well up to grounds. Patch up after other mechanics, and leave plastering in complete order on completion. Finish arch with beads in angles. Put up three centers, worth $1.50 each. Run cornices 5 in. × 8 in. in parlor, dining room, and hall. Furnish rough material for setting range, grates, hearths, and tile.

Cesspool, etc.:

Build cesspool 6 ft. diameter, 8 ft. deep in the clear, and privy vault 4 ft. × 4 ft. × 4 ft. deep, both with 12 in. dry stone walls. Privy vault to have two courses brick on top laid in mortar. Cesspool to have bluestone octagon flag 3 in. thick with iron cover.

Whitewashing:

Stop-point and lime-whiten the walls and ceiling of cellar.

Deafening:

Fill in with mortar the floors of all bay windows and projections that extend out beyond cellar.

Cistern:

Build a cistern 8 × 8 ft., 4 in. brick walls and bottom, arched over at top with manhole, cistern to be cemented tight, and warranted tight for one year. Cistern covered with octagon flag 2 ft. × 2 ft. square, with iron cover.

Timber:

Sill and corner posts 4 × 6, entertie plates 4 × 4, girders in cellar 4 × 8. Each tier beams 2 × 10 inches, 16 inch centers double for trimmers and headers, tail beams mortised into heads. Rafters 2 × 6, 2 foot centers, hips and valleys 3 × 7 inches. Piazza sills 3 × 6 inches, 2 × 6 timbers, 2 foot centers cut in between. All studding 2 × 4 inches, sixteen inch centers, doubled at openings, and partitions set with sill and plates. Framing to be done in the best manner, well nailed and stayed. All timber to be of sound and thoroughly seasoned white hemlock, free from shakes and other defects. All partitions to be thoroughly braced, each tier of beams to have two rows of herring bone bridging.

Furring:

Do all furring required to lath, to furr off under side of all stairs, and form segment arches where shown. Furr off attic for breast and first story stone wall.

Inclosing:

The entire frame from sill to plate, including roof, to be inclosed with hemlock boards, squared edges, covered with Eureka sheathing paper and (except gables) clapboarded with No. 1 beveled 6 inch clapboards, well lapped, carefully nailed, nails set. Gables, tower, and belt to be covered with sawed pine shingles to be cut ornamental.

Shingles, etc.:

All roofs to be shingled with 18 inch sawed white pine shingles, best quality, nailed to 1 × 2 spruce shingle lath.

Outside Trimming:

Water table 1¼ inches × 6 inches, beveled on top and tongued for siding. Corner boards 1¼ inches × 3 inches. Belt courses 1¼ inches by 3 inches. Moulded cornices, and gutters built in cornices. Eaves of seven-eighths inch narrow matched and beaded white pine. All details to be made as per working drawings of second quality seasoned white pine, free from loose knots or sap.

Floors:

1st, 2d, and 3d story floors laid with first quality narrow white pine flooring, 5½ inches wide, blind nailed. Two nails to each bearing. Do all cutting away for plumbers and other mechanics. Piazza flooring first quality narrow pine, free from sap, and joints leaded. No butt joints.

Windows, Window Frames, Sash and Blinds:

Plank frames for cellar windows as usual, one and a quarter inch sash, American glass. Outside casing 1¼ inches × 3 inches, jambs 1¼ inches, parting strips ⅝ inch by ½ inch, outside stops 1¼ inches × ¾ inch, inside stop ⅝ inch. All other sash 1½ inches thick, glazed with first quality French sheet, hung with hempen cord, iron weights, and iron axle pulleys; sash secured with patent window fastenings. Sash made of seasoned white pine, oiled. Casements sash to have domestic fasteners, stained glass where shown to cost $1.60 per square foot. All windows to have 1¼ inch outside blinds, rolling slats, hung with malleable iron blind hinges and strong fastenings, to be painted two coats by blind maker. Inside Venetian blinds in bay windows.

Doors, Hardware, etc.:

For height, width, and thickness of all doors, see plans. Front door glazed in upper part with rolled cathedral glass. Doors made of seasoned clear white pine, free from all knots and stains for oil finish. Sliding doors, 2 in. thick; closet doors, 1¼ in. thick; other doors, 1½ in. thick. All four-panel. Drawers underneath counter shelf in pantry to have locks. All casement sash to hang with iron butts to open out, and secured with the Domestic Fastener and Adjuster, outside cellar door and all batten doors hung with T hinges, cellar door to have padlock. All double hung sash to have 2 inch patent axle iron pulleys, iron weights, and best hemp cord, secured with the patent

sash lock. All doors to have $\frac{5}{8}$ inch beveled saddles of ash. Hardware will be of the Gilbert patent bronze first floor, balance porcelain. 3 in. × 4 in. mortise lock, $3\frac{1}{2}$ loose butts. Improved sash fastenings. Front door to have night works complete. All necessary clothes hooks.

Stairs:

To have 6 inch newel, turned ball on top, angle posts 4, chamfered and pointed both ends, 2 inch × 3 inch moulded rail, $1\frac{1}{2}$ inch turned balusters, all of seasoned ash, well cleaned down. Threads and strings $1\frac{1}{4}$ inches, 12 inches wide, risers $\frac{7}{8}$ inch, $7\frac{1}{2}$ inches high. Nosings and cove returned on strings. All glued, blocked, and wedged, and to have $2\frac{1}{4}$ inch × 4 inch carriages. Stairs to attic to correspond to main stairs, all pine, to have 1 inch treads, strings, and risers. Stairs to be got out of seasoned white pine, made and put up in a substantial manner. Put up smooth pine steps to cellar, and $1\frac{1}{4}$ inch pine threads and strings.

Inside Casings:

All inside doors to have 1 in. jambs with $\frac{1}{2}$ in. moulded strip to form rabbet, all well blocked for hinges. All doors and windows to have $\frac{7}{8}$ in. beaded casing 5 in. wide, as per detail, with back moulding, closets and attic $\frac{5}{8}$ in. plain casing 4 in. wide. All windows trimmed on to moulded stools with 3 in. beaded aprons below. The above trim for parlor and sitting room and hall to be of seasoned white pine, smooth and free from knots or other defects, for oil finish, first and second floor; painted in attic.

Base:

In 1st and 2d stories, except closets and kitchen, put down plinths 8 in. high beaded same as trim, and one base moulding, all scribed to floors and well nailed, and of same quality and kind of lumber as trim. Attic base plain $\frac{7}{8}$ in. × 6 beaded.

Angle Beads:

All plaster angles to $1\frac{1}{2}$ in. turned angle beads.

Closet Work, etc.:

Put up $2\frac{1}{2}$ in. strips for wardrobe hooks, where directed. All shelves put up on strong rebated cleats; shelve closets as follows: All closets to have two rows of shelving and one row of japanned double hooks. Butler's pantry fitted up with counter shelf 20 in. wide below, with three drawers underneath on one side, and two doors on opposite side, with sash doors to slide above. In kitchen, wainscot above sink two feet high around to window neatly capped, to be done with $\frac{7}{8}$ narrow matched and beaded pine. Put drain shelf to sink. Bath room wainscoted $3\frac{1}{2}$ feet high on all sides with $\frac{5}{8}$ in. narrow matched and beaded white pine capped, front of tub, W. C. & W. B., same closet under W. B. door hung and secured with button, cap of tub, seat and lid and W. C. one $1\frac{1}{4}$ in. stuff; lid hung on brass hinges. Build coal bin, capacity 10 tons, in cellar, also pantry in cellar as directed.

Rear piazza and Bay Window:

Round off flooring on front edge and finish with cove and favia. Fill in between piers with $\frac{1}{4} \times 1\frac{1}{2}$ in. lattice. Plate 2 × 3 in. let into posts, finish under plate over doorway with $1\frac{1}{2}$ in. rail, moulded, finished with clapboards. Form moulded gutter in cornice, ceilings boarded with $\frac{5}{8}$ in. narrow matched and beaded pine, shingled as per main roof; steps same as floor, and strings $1\frac{1}{4}$ in., risers $\frac{7}{8}$ in. Rear porch to have strong floor timbers, 1 in. floor, steps and risers, not inclosed, roof of same shingled, and supported by brackets or posts.

Mantels:

Will be provided by the owner, must be put up by carpenter.

Clothes Posts:

Furnish and set for house four chestnut turned posts, set 3 ft. in the ground.

Privy:

$4\frac{1}{2}$ feet square, double faced matched boards, battened, shingle roof plain spruce frame, ceiled over head, battened door with thumb latch and bolt, 4 light sash, strong floor timbers, wide floor, seat with 2 holes, 1 child's seat, lids chamfered and hung. Build outside cellar doors complete. Build two wash trays of 2 in. lumber with lids and legs complete, lids hung on brass hinges; inside measurement of tubs to be, depth 16 in., width $22\frac{1}{2}$ in.; length, $26\frac{1}{2}$ in. high, supplied through nickel plated patent cocks, to have plug, chain, etc., complete. Furnish, fit up, and connect one wash out water closet with white earthenware bowl, and drip porcelain supply tank above.

Painting:

Outside woodwork to have two coats of best Atlantic white lead, and linseed oil in three colors, roof stained. Interior, one coat of filler and one coat of hard oil.

Tinning and Plumbing:

Furnish all necessary flashings for windows, valleys, etc., line gutters, and do all tinning required by the drawings, also furnish and put up 3 in. tin leaders where shown. Supply pipes, AA, $\frac{5}{8}$ lead.

Waste:

Run 4 in. cast iron soil pipe from drain, at least 3 ft. outside cellar wall and 4 ft. above roof, finished with ventilator. To have necessary branches, etc., joints calked with molten lead; sink, bath, and wash bowl waste through $1\frac{1}{4}$ in. D pipe. Sink and wash bowl to have S traps with screws. Bath waste to run to water closet trap. Sink waste to drain into main pipe at cellar. All pipes to be thoroughly tacked to boards and between beams packed with mineral wool. Plumbing to be guaranteed for one year. Two wash tubs and connection in kitchen, with hot and cold water with waste.

Gas Fitting:

Run all necessary gas pipe of suitable size for outlets as shown and in accordance with rules and regulations of the Orange Gas Company.

Bell:

At front door 4 in. gong.

Furnace and Range:

Furnish and put up in cellar one No. 44 Boynton Climax portable furnace complete; pipes running through floors to have tin collars and be well protected where required, to have tin register boxes, casings, and black japanned registers, with frames set in walls where practicable. Furnish and set in kitchen one Duplex range with water back complete.

Plumbing:

Connect with city water in cellar and run $\frac{5}{8}$ in. AAA pipe throughout for all connections. (If no city water, line a tank 6 ft. x 4 ft. x 4 ft. in attic to supply bath, sinks, boiler, closets, and tubs.)

Kitchen:

Furnish and set in kitchen one 18 x 30 cast iron sink with legs, supplied with hot and cold water through $\frac{5}{8}$ in. patent brass cocks. Furnish and set one 40 gallon galvanized boiler connected with water back of range. Put in sediment cock to boiler. Run circulating and escape pipe from boiler.

Pump:

Furnish and set complete a Coleman ship pump in kitchen, supply tank from cistern also direct to sink.

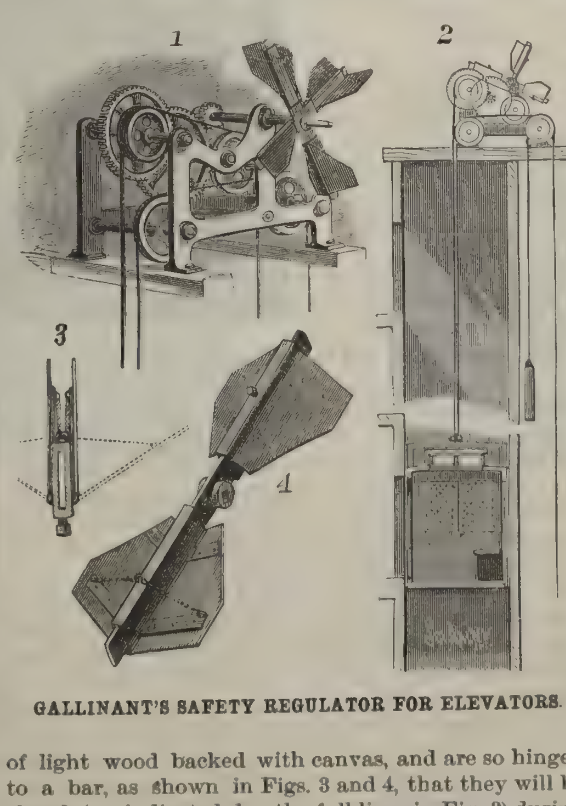
Bath Room:

Furnish and set one $5\frac{1}{2}$ ft. 14 oz. French pattern copper planished overflow tub, supplied with hot and cold water through $\frac{5}{8}$ in. nickel plated patent cocks, to have nickel plated plug, chain, etc. Furnish and fit up 14 in. marble style overflow basin, $1\frac{1}{4}$ in. moulded and countersink slab, 1 in., moulded base, 6 in.

A NEW SAFETY REGULATOR FOR ELEVATORS.

A new system to prevent the falling of elevator cars from any cause whatever has recently been patented by Mr. Adolphe Gallinant, of 862 Palisade Avenue, West Hoboken, N. J.

The arrangements for raising and lowering the car are similar to those in common use, the hoisting ropes being secured to the crosshead of the car, thence passing over pulleys located at the top of the shaft and then down to the hoisting engine. A second or auxiliary rope is secured to the car, passed twice or more times around a drum mounted on a shaft journaled in a frame placed at the top of the well, thence over a pulley in the frame and down to a counterbalance weight. This weight is not heavy enough to offset the weight of the car, but is designed to always keep the rope taut, so as to prevent all possibility of its slipping on the drum. Mounted on the same shaft with the drum is a gear wheel that meshes with a pinion on a shaft carrying a second gear wheel; this meshes with a pinion on a shaft carrying the fans. The fans are made



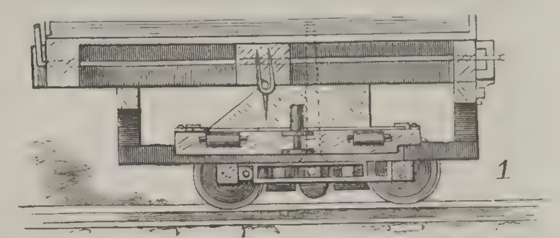
GALLINANT'S SAFETY REGULATOR FOR ELEVATORS.

of light wood backed with canvas, and are so hinged to a bar, as shown in Figs. 3 and 4, that they will be closed (as indicated by the full lines in Fig. 3) during the ascent of the car, and will be opened (as indicated by the dotted lines) during the descent.

In case the hoisting ropes should break, the fans would be brought into operation to sustain the car, which would descend at a perfectly safe rate of speed; and the auxiliary ropes, having no work to perform except carrying the small counterweight, would not be liable to wear, and could always be relied upon to accomplish this. In general practice, the length of the fans—from out to out—should be one-half the width of the shaft, but it will be readily perceived that by changing the number and size of the fans the speed of the car while descending may be perfectly controlled. This device may be easily adapted to any of the elevators or dumb waiters now in use without changing any of the existing parts. Among the many advantages it possesses are its non-liability to get out of order, wear upon the reserve ropes is reduced to a minimum, it is automatic in action, and requires little or no attention.

DUMPING CAR.

The improved dumping car herewith illustrated unloads either sidewise or endwise, and is so constructed



COOK & SUMMERS' DUMPING CAR.

that the car and load cannot be thrown off the track when running on an uneven surface. The truck bed is provided with a pin projecting into the bed plate, and with friction rollers on which a disk, projecting a short distance beyond the bed plate, rests. One side of the bed plate is inclined, as shown in both drawings. To facilitate unloading, the front end of the car is a trifle wider than the rear. The car body is attached to a frame consisting of side and end beams and a center beam; the latter is hinged to the upper edge of the incline, and the side beams rest on the end beams of the truck frame, as shown in the sectional view, Fig. 1. At the front end of the body is a hinged door, which can be locked or unlocked from the rear by a bent rod. Secured to either the side or rear is a handle, by which the body can be turned on the pin. The brake shoes are operated by cams placed on the ends of a central rod moved by a lever.

The load is dumped sidewise by unlocking the car frame, unfastening the hinged door by turning the bent rod downward, and then swinging the car body at right angles—to the position shown in Fig. 1—by means of the handle. As soon as the car frame has cleared the end beams of the truck frame, it will tip over on to the incline, as shown in Fig. 2. The load can be dumped endwise by lifting the rear end of the car upward, using the front axle as the pivotal center; the rear wheels remain on the track, as the rear axle is hinged to the front one by a frame. By removing the car body, frame, and bed plate, the truck can be used as a timber car.

This invention has been patented by Mr. S. W. Cook and Henry Summers, of Bozeman, Montana.

THE NEW YORK WATERWORKS.

In connection with the remarkable aqueduct now in progress for increasing the water supply of New York city, which we illustrated in November number, we give below an engraving of the great Quaker Dam which is to form a part of the same extraordinary work. We also add the following particulars of the city water supply:

In 1774, when New York city had a population of 22,000, Christopher Colles built a reservoir on the east side of Broadway about one and one half miles from the Battery, and sank a well on the bank of the Collect. This was the first attempt to supply the city with of 50 feet above tide, and was pumped by a 12 horse power engine into an iron tank 20 feet high by 44 feet across, and placed at an elevation of 84 feet above tide. There was laid in connection with the reservoir a line of 12 inch cast iron pipe to William Street, with 6 and 10 inch branches—a total of 34,700 feet. The pipe cost $70,950, and in January, 1833, the works had cost $42,233.

At that time the supply was so small that some 600 hogsheads of water were brought in daily from the country and sold for about $1.25 each. In 1834, the Thirteenth Street well was increased 100 feet in depth by a 2½ inch bore, which added 20,000 gallons to the daily another storage reservoir. The total capacity of the storage is 9,000,000 gallons.

The aqueduct from Croton Dam is of masonry, lined with brick, and has a sectional area of 53·34 square feet. The Harlem River is crossed by the famous High Bridge, built of granite masonry, and having 8 spans of 80 feet and 7 spans of 50 feet, its length being 1,393 feet between the gate houses. The height is 100 feet in the clear above tide water. The water was first carried across in two 36 inch pipes, but in 1860 the capacity was enlarged by the addition of a wrought iron pipe, 7 feet 6½ inches in diameter. This makes the pipe equal in capacity to the aqueduct.

VIEW SHOWING THE CONTEMPLATED QUAKER DAM ACROSS CROTON RIVER—NEW YORK WATER SUPPLY.

water, and its completion was prevented by the Revolution. Twenty-five years later the Manhattan Company built a well near the Collect, 25 feet in diameter and 30 feet deep; from this, water was pumped by two steam engines, of 18 horse power each, into a reservoir on Chambers Street. The distributing pipes were bored logs, 25 miles of which had been laid in 1823, supplying some 2,000 houses in addition to manufactories. In 1830–32 the same company sank a well corner of Broadway and Bleecker Street, 8 inches in diameter and 442 feet deep; a 6 horse power engine got 44,000 gallons daily. During the same year the city built for the Fire Department a well on Thirteenth Street near Broadway, 16 feet in diameter and 112 feet deep, nearly 100 feet of which was through rock. Twelve feet from the bottom two galleries, each 4 by 6 feet, were run out for a distance of 75 feet; a branch 25 feet long was extended from one of these. The water rose to a height supply. Water was also forced into the reservoir from a well near Jefferson Market, 30 feet deep and 16 feet diameter. Eighty thousand feet of cast iron pipe had been laid from the reservoir for the use of the Fire Department up to 1835 at a total cost of $182,852.

A plan to take water from Croton River was adopted by the Common Council in 1835. Across the river was built a dam having an overfall of 90 feet long in masonry, the balance being earth embankment. This was washed away by a freshet early in 1841, and when reconstructed the overfall was made 180 feet in length.

In 1866–72 a dam 78 feet high from the rock foundation, 670 feet long on top and 8¾ feet wide, was built for a storage reservoir at a point 23 miles from Croton Dam. Another storage dam was built on the middle branch of the Croton in 1874–78. Plans are now being carried out for a dam at Kensico, on the Bronx River, for

Before 1840 a rectangular reservoir 836 feet wide, 1,826 feet long, and 20 feet deep, holding 150,000,000 gallons, was built about six miles from the Battery. Twenty years later a receiving reservoir having a capacity of 1,200,000,000 gallons was built next to this one. The distributing reservoir at Forty-second Street is 400 feet square, and holds 24,000,000 gallons. A high service reservoir holding 10,800,000 gallons was built in 1866 at the west end of High Bridge. Engines supply an iron stand pipe and tank, the flow line from which is 324 feet above the tide level.

Elevations greater than this aqueduct are supplied by the two steam engines at High Bridge, which have a combined daily capacity of 10,000,000 gallons. In 1879–80 another high service supply was obtained from two engines pumping into a stand pipe 170 feet high located at Ninety-eighth Street. All of the water mains are of cast iron.

For several years the supply furnished by the present works has been insufficient; the population and manufacturing interests have grown more rapidly than was dreamed of, and, judging by the past, will continue to increase in a yearly greater proportion. That the case is urgent and demands quick and effective measures is not disputed. Two plans present themselves: one is to build so as to meet immediate wants, the other is to build to meet future wants—in other words, to build for ourselves only, or to build for our children's children. Nothing can show the fallacy of the first method better than the brief sketch above given of New York's water system, which has been only a succession of patches added every few years, each addition being probably made in the vain hope that the city would stop outgrowing its water supply. The alternative is to so build that we shall be prepared to supply an ample quantity of water for all the wants of all the people of New York city for all time.

Purity of the source of supply is the first and most important consideration. It would be hazardous to utilize a watershed which would require a system of drainage to remove material that might contaminate the water. It would be extremely foolish to take a water supply from a built upon section of country, every foot of which would have to be rigidly, carefully, and constantly guarded to keep away impurities. In deciding upon a plan to provide water for a city of the size and importance of New York, it is false economy to let the question of cost prevent the adoption of that scheme which will best meet all the requirements.

Several plans are now being considered by a commission appointed about a year ago to select a plan for obtaining an adequate supply. One of these is shown in our frontispiece. It contemplates damming the Croton River at Quaker Bridge, a point about four and one-half miles below the present Croton dam. This would catch all the water from the small tributaries of the Croton, the total watershed of which amounts to 362 square miles. The dam will measure about 192·5 feet from the top to the top of the foundation; and in the deepest part the foundation will be 69 feet high. The width at the base will be about 200 feet, and at the top 22 feet, on which will be a roadway. The length at coping will be 1,350 feet; length at datum level will be 510 feet; width at that level, 172 feet. Along the top of the face of the dam will be a line of arches forming a cornice. The outline drawings show a cross section and plan. The foundation will be concrete, and the main dam rubble masonry faced with stone work. The estimated cost of the dam is $5,000,000.

At the north end of the dam will be two spillways, formed between two knolls placed in a line, making an angle (down stream) with the dam. The waste water will run down a ravine, entering Croton River some distance below.

At a distance of six miles above Croton dam will be placed Muscoot dam, a subsidiary one designed purely for sanitary purposes; it will be the same height as the spillways of Quaker dam. The duty of this dam will be to keep the country constantly flooded, even if the water should be drawn off from both the Croton and Quaker ponds. The Quaker dam would raise the water level 34 feet above the top of the present Croton dam.

The present aqueduct will be connected with Quaker Pond at three levels, thereby permitting the selection of the purest water in the pond to be sent to the city. The old gate house at Croton dam will be enlarged and connected with both the Croton and Quaker ponds at different levels, to allow the drawing of water from either source. A new aqueduct will lead from here to the city. An aqueduct will connect Muscoot with Quaker Pond in order to allow Croton Pond to be emptied without interfering with the supply. Openings will be made through Quaker dam, in order that the water may be drawn off if necessary.

It is calculated that Quaker dam will impound thirty-two billions of gallons of water, which would be sufficient for a 160 days' supply of 200,000,000 gallons each.

LANDSCAPE ARCHITECTURE.

Vitruvius relates that the architect Dinocrates proposed to Alexander the Great to carve Mount Athos in such a way as to give it the shape of a man, whose one hand should support an entire city, and whose other should carry a cup which received all the waters from the mountain, and from which they overflowed into the sea.

Alexander, charmed with the idea, asked him if this city was to be surrounded by land capable of supplying it with the grain necessary for its subsistence. Having ascertained that the provisioning could only be done by sea, Alexander said: "Dinocrates, I grant the beauty of your project; it pleases me, but I think that any one who should take it into his head to establish a colony in the place you propose would run the risk of being taxed with want of foresight; for, just as a child can neither feed nor develop without the milk of a nurse, so a city cannot increase without fertile fields, have a large population without plenty of food, and allow its inhabitants to subsist without rich harvests; so, while giving the originality of your plan my approval, I have to say to you that I disapprove of the place that you have selected for putting it into execution. But I want you to stay near me, because I shall have need of your services."

Fig. 1.—LANDSCAPE BY FATHER KIRCHER.

This gigantic project had doubtless been suggested to the Macedonian architect by the singular forms that certain mountains affect. It is not rare, in fact, to see human profiles delineated upon the sky, and this phenomenon especially happens in countries where the folded limestone strata have been broken up in such a way as to give rise to deep valleys perpendicular to the direction of the chain. If we look at these folds from below in an oblique direction, we shall see them superposed upon one another in such a way as to represent figures that recall a human profile.

In the seventeenth century, Father Kircher conceived the idea of taking up Dinocrates' plan upon a small scale, and composed the landscape shown in Fig. 1. The drawing remained engraved for a long time upon a marble tablet set into the wall of Cardinal Montalte's garden at Rome. Later on, artists improved and varied this project, as shown in Figs. 2 and 3. By looking at these cuts from the sides of the page, it will be seen that they form human profiles. Fig. 2 represents an old woman, and Fig. 3 a man whose beard and hair are formed by shrubbery.

Figs. 2 and 3.—LANDSCAPES SHOWING PROFILES OF HUMAN FACE.

We do not think that these conceptions have ever been realized, although Heron in his treatise on Dioptra, and Father Scott in his Parastatic Magic, have described instruments that permit of making the necessary outlines to cause grounds to present a given aspect from a given point. These instruments consist essentially of a vertical transparent frame, upon which is drawn a vertical projection of the landscape that it is desired to obtain.

SOLDER FOR IRON, BRASS, ETC.—Chloride of zinc dissolved in alcohol will make a good flux for soldering iron, brass, or other metal.

No Right to Steal Away Your Employer's Business.

In Van Wyck *vs.* Horowitz, New York Supreme Court, special term, 28 Daily Reg., 305, the question as to the right of a party to use another name upon his business cards, etc., by saying "late with," etc., is discussed. In this case the defendant, who had been employed by plaintiff as a workman upon jewelry and in the repair of watches, set up in a business similar to that kept by plaintiff, and put upon his cards and upon a sign in his store "Late with James P. Van Wyck." This use of his name the plaintiff sought to restrain, and the court granted a motion to continue an injunction, saying: The statement of the case evokes instant condemnation from the hearer, and an analysis of the thoughts which produce such instantaneous conclusions will show that it rests upon sound legal principles as well as upon the conscience of the hearer.

The defendant has no right of property in the name nor in the reputation of that business which he seeks to use with his own name and business so as to give his own prominence at the expense of the other. If the defendant had been a stove blackener, or hostler, or an errand boy in the employ of the plaintiff, or a clerk discharged for want of fidelity or competency, he could with just as much truth advertise himself as "late with James P. Van Wyck." The extreme supposed cases are put to illustrate the danger of the counsel's position. It cannot be that a man who has sustained any position toward or had any employment for a well known individual, that thereby he obtains the right to use that name in connection with his own, so as to advertise himself and his business at the expense of his former patron and employer, and to do it in a manner which is likely to, and often must, deceive as to the nature of the relations to him.

The motion to continue the injunction must be granted, because—

First. The defendant is, without authority, using the plaintiff's name, which is the use of another's property for his own benefit and to the injury of its owner.

Second. He is attempting to transfer to himself a part of the reputation of the store and business of the plaintiff, which also belong to the plaintiff as really and as truly as his name or his personal property of which he is the actual owner.

Third. The mode and manner of the use by the defendant of the name of the plaintiff are such as oftentimes to deceive, and because liable to deceive, and thus benefit the defendant at the expense of the plaintiff, such use must be held to be unlawful.

Sawdust in Plastering.

Two Western inventors have recently obtained patents for the use of sawdust instead of sand in plastering compositions, and this, it is conceived, may be a matter of considerable importance to the owners of sawmills in the principal lumbering towns. One of the patents is for the use of nearly equal parts of plaster of Paris or cement and sawdust, with the ordinary amount of plastering hair and water; the other calls for the use of about 4½ pounds each of slaked lime and sawdust to 1 pound of plaster of Paris, a quarter of a pound of glue, and a sixteenth of a pound of glycerine, with plasterer's hair. Whether or not either of these described plasters would be cheaper than those made in the ordinary way, they would certainly be lighter, and it is believed that they would better adhere to the walls, and not be so liable to chip, scale, and crack. Sifted sawdust has before been used to some extent by experienced workmen for mixing with mortar for plastering external walls, exposed to the alternate action of water and frost, as a preventive of scaling. Certainly the experiment of introducing sawdust in place of sand in mortar is worth trying, for in many places sharp sand suitable for the purpose is difficult to obtain.

THE attraction of gravity is greatest at the earth's surface. It is nothing at the center.

H. M. S. BENBOW.

The Benbow, built at the Thames Ironworks, Blackwall, and recently launched, is a ship to which special interest naturally attaches at the present time, because she is perhaps the most remarkable vessel of the new citadel type representing the ships termed the Admiral class, being all named after celebrated admirals—that is, the Howe, the Anson, the Collingwood, the Camperdown, the Rodney, and the Benbow. The Benbow differs from the others in carrying in each of her barbette towers one 110 ton breech loading gun instead of two smaller pieces. It is this fact that constitutes her most notable feature. The 110 ton breech loading gun ordered from Elswick is 43 ft. 6 in. long; its caliber is 16·75 in. It fires a charge of 900 lb. and a projectile weighing 1,800 lb., with a muzzle velocity of 2,020 ft. per second, giving a muzzle energy of 61,200 foot tons, with a calculated perforation of 30·5 in. of wrought iron, and an energy per ton of gun of 513 tons. These figures will be found to imply that it will be the most powerful gun in the world at present, Krupp's 119 ton gun having only 46,061 foot tons calculated muzzle energy. The Benbow is also interesting as being built by contract, for at the present moment it is very important to learn the relative advantages and disadvantages of building by contract and in the royal shipyards. The Benbow is of the mastless type, having only a pole with a top for two machine guns. She has compound armor in a belt about 8 ft. wide and 18 in. maximum thickness along her water line amidships, with a 3 in. steel deck at the top of the armor, and a horizontal armored deck fore and aft of her citadel. She is 330 ft. long and 68·5 ft. wide. Her displacement will be over 10,000 tons, perhaps running up to 10,500 tons. She has 9,000 horse power, and her speed is hoped to be 16 knots. Her barbettes are protected by 14 in. of compound or steel faced armor built at an angle, as shown. Her armament is as follows:

On her hurricane deck she carries eight quick-firing Hotchkiss 6 pounder guns and four Nordenfelt machine guns, probably four barreled 1 in. Nordenfelts in small projecting towers. On her battery deck are ten broadside 6 in. new type guns, those at the fore and aft ends of the battery training round so as to fire if need be through ports made for firing directly fore or aft. There are also on this deck four quick-firing guns and six machine guns, four in towers and two carrying shields on their carriages. In her barbette towers are the two 110 ton guns. There are also four smaller five barreled Nordenfelt machine guns, 4·5 in bore. Her top is designed to carry two machine guns. Torpedoes can be discharged ahead, astern, and abeam.

The guns on the barbette towers are of course much exposed, but the gun detachment is down below a steel circular 3 in. revolving deck. The gun is loaded by running back and lowering the breech. The type to which this vessel belongs is one which we need hardly say has been the subject of long and bitter attack by Sir Edward Reed. At present this line of criticism meets with approval from some of the best known naval officers. On the other hand, others think it has been pushed to unreasonable lengths. Citadel ships leave their ends exposed at the water line. The French barbette class, represented by the Admiral Duperre, have armor along their water line from end to end at the expense of exposing the ship in other places.

At Alexandria no shell that passed into the unarmored part of any of our vessels did serious damage, and until the introduction of quick-firing guns, few officers would, we think, believe that ships could be destroyed by such fire. It is now urged that quick fire may very quickly riddle a vessel along her water line, and so cripple her that she may be rammed. Both classes of vessels may be capsized by destruction of unarmored parts, as has been shown at the Admiralty by model experiments. But the adversaries of the citadel type urge that water is liable to enter and interfere with speed. On the other hand, such a vessel as the Admiral Duperre has her men so entirely exposed that it may be questioned if she could keep a man at any of her guns under the fire of quick guns and machine guns Some officers believe that the effect of quick fire is at present overrated. It appears probable that the construction of our ships may be so far affected by quick fire as to cause a thin belt of armor to be extended at the waterline to turn off the great mass of quick fire which may be assumed to fall on it more or less obliquely. As to ramming powers, the Benbow has a spur strengthened with a horizontal flange, and her bows are stiffened with her horizontal armor deck. With her twin screws she ought to be fairly handy.—*The Engineer.*

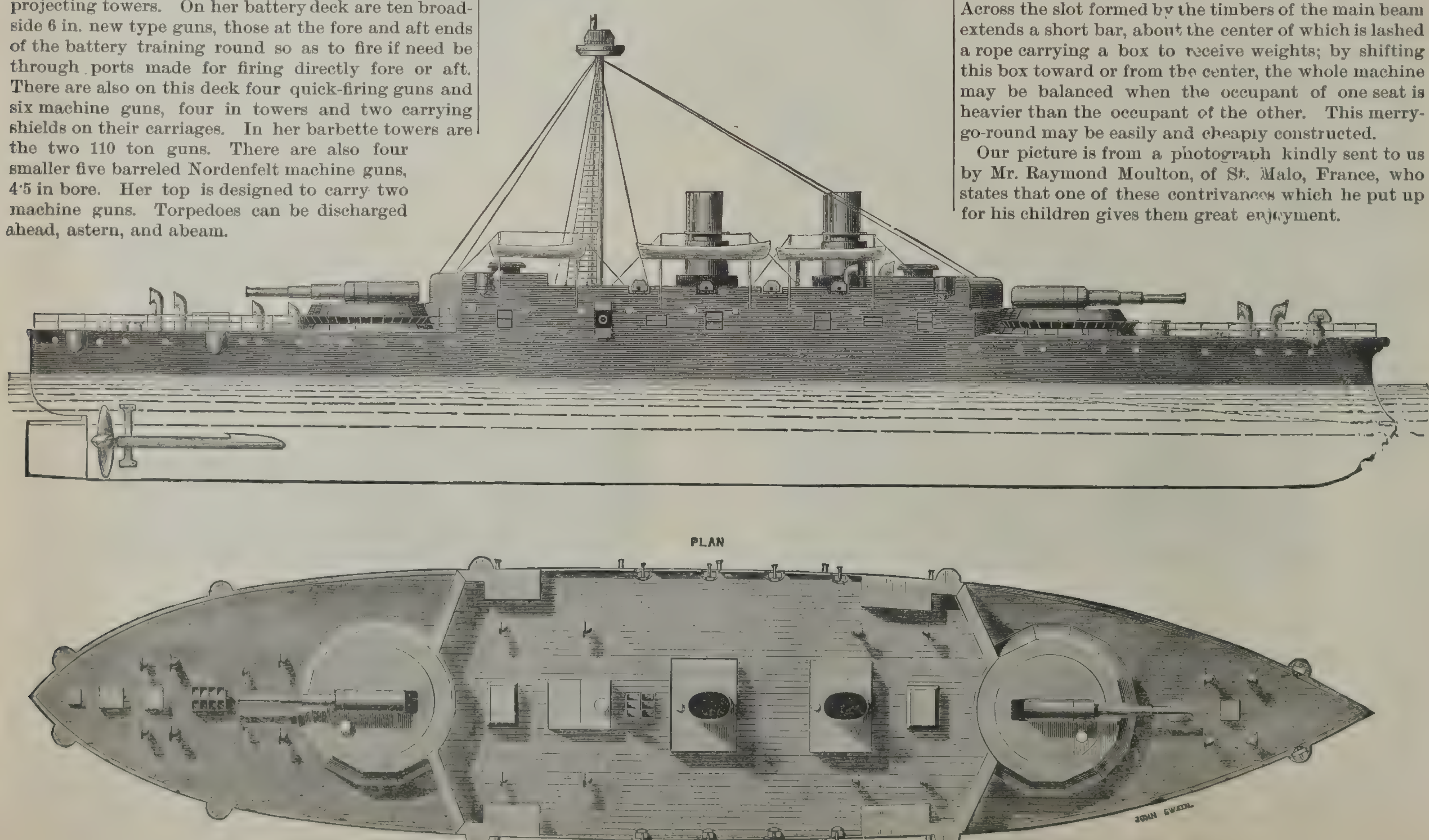
SAIL RIGGED MERRY-GO-ROUND.

SAIL RIGGED MERRY-GO-ROUND.

Our engraving shows a merry-go-round consisting of a braced standard upon the top of which is centrally pivoted a beam provided at either end with a mast and sails, and with a seat suspended by four ropes. The standard is a post six or eight inches square, and of the desired height, resting upon crossed timbers, the ends of which may be pegged to the ground or which may be made of a length sufficient to prevent tipping over; four braces support the standard. The main beam is composed of two timbers about eight inches wide and one and a half or two inches thick and of any desired length—twenty or twenty-five feet would answer admirably.

These two pieces are separated by blocks at the ends and center and bolted together, so as to form a square box without top or bottom. Upon the upper side of the center of the beam are two blocks of wood held by two bolts; the under block carries a socket which rests upon the end of a long pivot bar projecting from the top of the standard; of course this bar is long enough to permit the beam to swing clear of the standard. Across the slot formed by the timbers of the main beam extends a short bar, about the center of which is lashed a rope carrying a box to receive weights; by shifting this box toward or from the center, the whole machine may be balanced when the occupant of one seat is heavier than the occupant of the other. This merry-go-round may be easily and cheaply constructed.

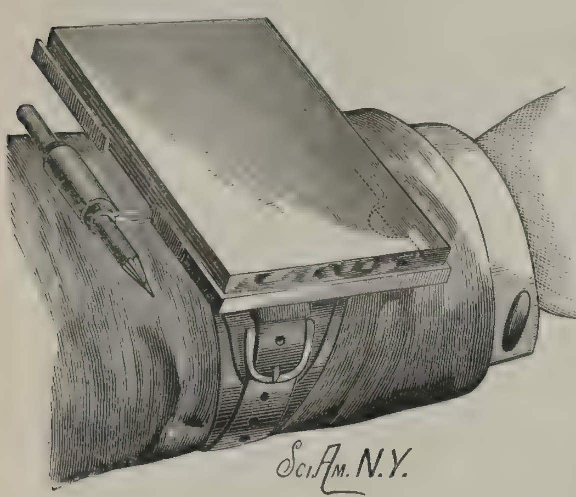
Our picture is from a photograph kindly sent to us by Mr. Raymond Moulton, of St. Malo, France, who states that one of these contrivances which he put up for his children gives them great enjoyment.



THE NEW BRITISH WAR STEAMER BENBOW.

A WRIST-HELD MEMORANDUM PAD.

A means of avoiding the annoyance and inconvenience caused by misplacing memorandum pads and pencils, when one is occupied with work of various details, is shown in the accompanying illustration. Light metal plates are so made as to hold a pad by its pasteboard bottom, and to these are attached a strap to pass around the arm at the wrist, and buckle. Integral with these plates is a looped strip with a rubber



BOYLE'S HOLDER FOR TABLETS AND PENCILS.

tube for holding a pencil. The device is such that pads can be conveniently renewed therein as desired, and, with it buckled on the left wrist, one can readily write on the pads as occasion may call for, with the least possible interruption to other work.

This invention has been patented by Mr. Peter Boyle, of No. 350 West Congress St., Chicago, Ill.

Sand Dunes.

Nature gives the following interesting account of a successful scheme of overcoming the movement of sand dunes: M. Cambrelent, Inspector of Public Works, has made a report to the Agricultural Society of France on the subject of the sand dunes of Gascony. These sand hills cover a surface of more than 85,000 hectares; they are more than 80 meters high, and 5 to 6 kilometers wide. Before a method of arresting these was discovered, they were being constantly pushed inland by the winds, invading and covering fields, villages, and even burying churches up to their towers. In 1780 Bremontier sought to render them immovable by planting them, after many experiments designed to develop a primary vegetation. His work has been continued with perseverance, and it is only recently that it has been completed, and these 85,000 hectares, which menaced all the country adjoining, have become covered with a rich forest vegetation which has fixed the dunes in one place. A great public danger has been converted into a large forest. But this work, which renders permanent dunes already existing, has not prevented the sea from throwing up on the coast new sand day by day, which forms dunes, which in their turn invade the permanent dunes. After having fixed the old sand hills, the problem was to prevent the formation of new ones. To solve this, it was decided to construct a dune above high water, in which all the conditions of the movable dunes would be reversed. The form given to the latter by the wind is such that on the side of the sea they present a gentle slope, which the sand can mount easily as on an inclined plane, in order to fall down a steep decline. It is by the gentle slopes forming a series of inclined planes that the sand moves forward. The formation of the new dune was encouraged, but it was directed in such a manner that it had a steep slope on the side of the sea. To secure this, a wooden palisade was erected about 120 meters away from the sea, all along the shore. The sand first struck against this in its progress and fell at its foot, a portion of it escaping through the interstices left between the planks. The latter was carried some distance by the force of the wind, and fell, forming slight slopes, while the sand which fell at the foot of the palisade on the side near the sea formed a steep incline. Soon this reached the top of the palisade, and then the planks were drawn up by means of a special implement to the needed height, and the formation continued as before, the slope on the side of the sea growing steeper, while the other got more and more gentle. Ultimately the dune reached such a height (generally ten to twelve meters) that the sand can no longer get over it, and it is definitely arrested between the barrier and the sea. It falls back on the shore, unable to advance, until contrary winds come and blow it out to sea again. To fix the sand on the other side of the barrier, the Arundo arenaria is planted. The roots penetrate to a depth of four or five meters, and the plant always keeps its head above the increasing sand. The results obtained by this new dune (says M. Chambrelent) have been complete. The most violent storms have not been able to carry the sand over it; the latter has fallen back on the shore innocuous, and the advance of the inexhaustible sand coming from the sea has been absolutely arrested.

SAIL SKATING.

When the ports of the Baltic are closed by ice during winter, the pilots and sailors of Arnager Isle, at Copenhagen, delight to occupy their leisure hours with the exercise of skating by sail. This sport requires much skill and quite a long apprenticeship; but, after a person has become dexterous at it, it offers a very peculiar charm, and, when a swift wind causes him to glide over the surface of the ice, he feels himself lifted, as it were, and experiences a sensation analogous to that of flight. We give in Fig. 1 a diagram of the apparatus, such as we have seen it employed by the Danish skaters, and such as we have employed it ourself. The sail, which is formed of a light but strong fabric,* is stretched over a bamboo frame whose dimensions are given in the cut. The center crosspiece, which must be placed at the level of the shoulders, is fastened to the skater's body by bands that cross the breast and afterward pass around the waist, so that they may be tied together in front. Large crosspieces of wood, attached to the lower corners of the system, are held in the skater's hands, so that he may trim the sail in one direction or another. When the skater wishes to be carried along by the wind, he must stand

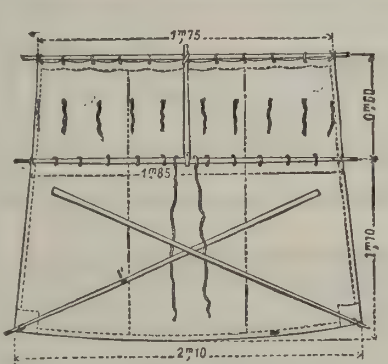


FIG. 1.—DIAGRAM OF THE SAIL AND ITS FRAME.

FIG. 2.—DOWN THE WIND. FULL SAIL.

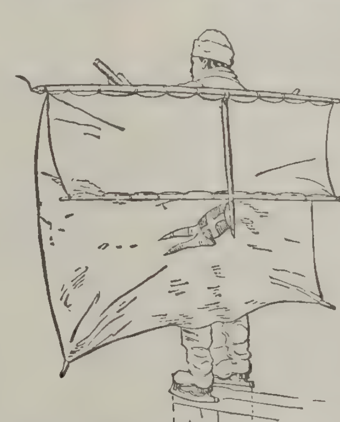


FIG. 3.—DOWN THE WIND. TOPSAIL LOWERED.

FIG. 4.—STARBOARD TACK.

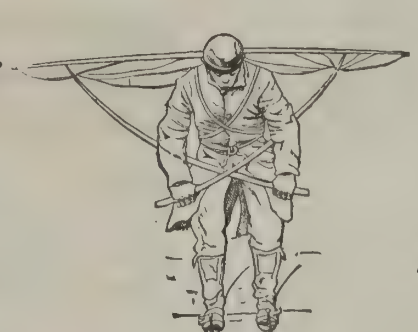


FIG. 6.—IN THE WIND'S EYE.

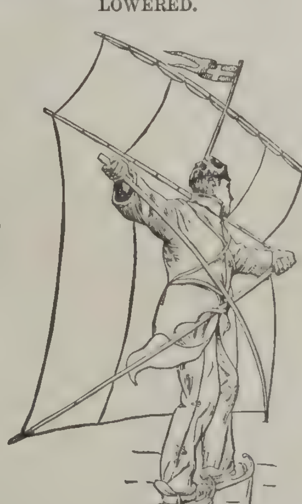


FIG. 5.—LARBOARD TACK.

SAIL SKATING.

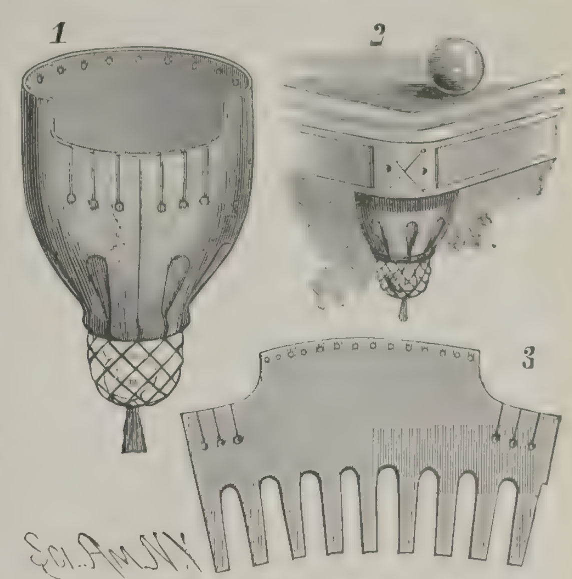
very erect, without stiffening his body too much, and bend backward in proportion as the wind blows fresher. Confidence is acquired by practice. Fig. 2 gives the position of the skater going with the wind and under full sail. When the wind is too violent, the topsail may be readily lowered (Fig. 3), so as to thus moderate the impulsion derived from the moving air. By inclining the sail in one direction or the other, the skater may tack to the larboard or starboard (Figs. 4 and 5). Finally, when it is desired to move against the wind, by skating in the usual way, the body is bent forward in such a way that the sail lies horizontally, and no longer offers a purchase to the aerial current (Fig. 6). The skater can thus return to his starting point, and from thence be driven forward again by the wind.

This exercise is a very agreeable one, and not very dangerous; and the falls that a person gets in beginning are not to be dreaded, because they almost always occur backward. The degree of speed that can be attained by a practiced skater is considerable, and yet is less than that of certain ice boats when these are sailing in high winds. When the skater gets through using his apparatus, he detaches it from his shoulders, winds the sails around the bamboo sticks, which may be separated from them, and thus has an object that is no more trouble to carry than an umbrella would be. When the winters are severe, it is not unusual to meet upon the ice numerous groups of skaters by sail who are endeavoring to excel each other in speed. Young people are often seen, too, setting out on an expedition over the frozen sea between Denmark and Sweden, and traversing the entire Sound. These latter use the sail when the wind is favorable, but fold up the apparatus when the contrary is the case, and make use of their skates in the ordinary way.

Danish hunters, likewise, often have recourse to skating by sail in order to rapidly reach points where wild ducks and geese have been observed. On one of these hunting excursions we chanced to pursue an unfortunate stray fox over the ice, and competed with him in speed when he was running in the direction of the wind. We came very near catching him in the race.—*La Nature.*

* Chinese pongee silk is admirably adapted for the purpose.

IMPROVED POCKET FOR BILLIARD AND POOL TABLES.

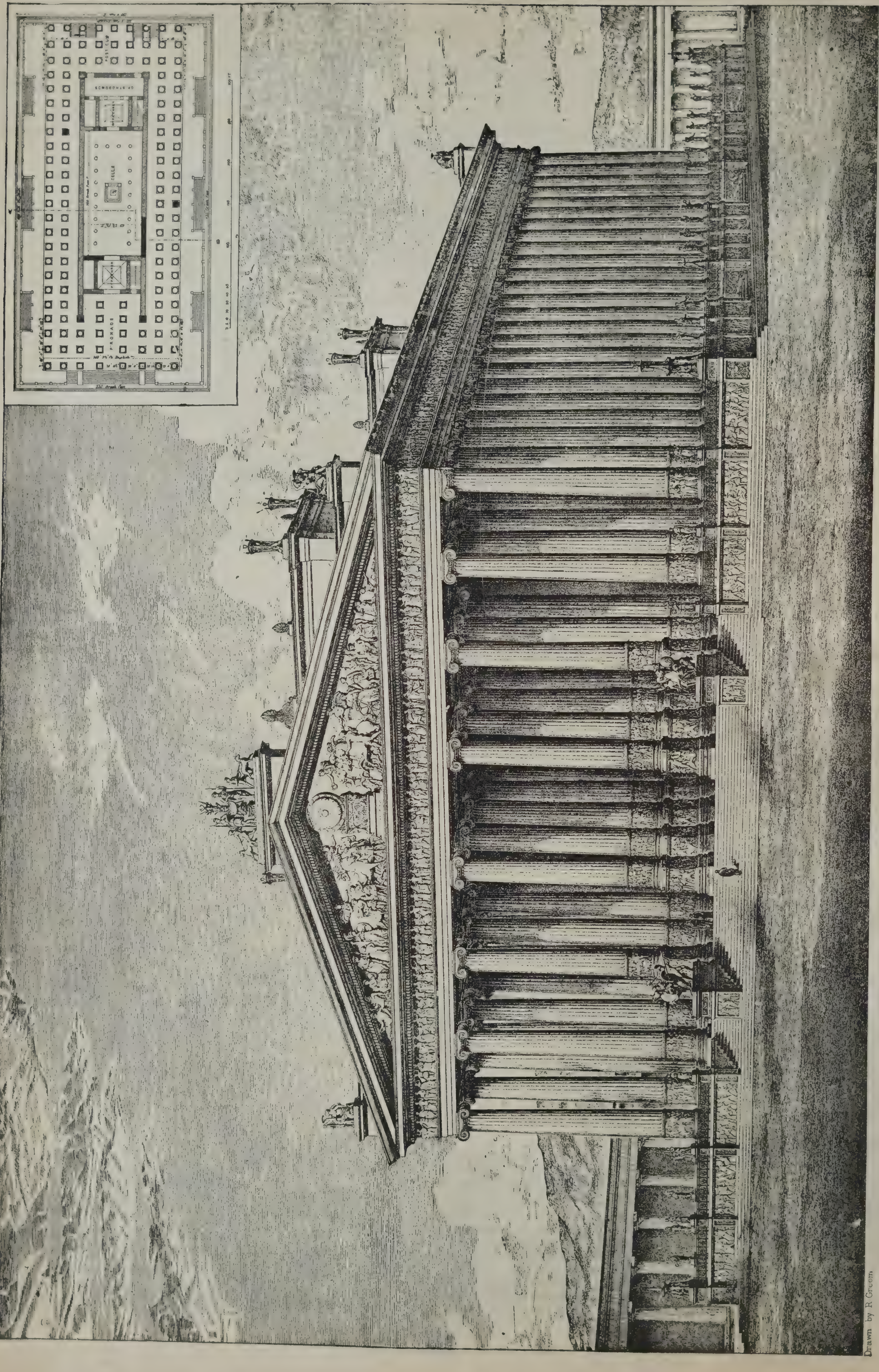


SEELY'S BILLIARD TABLE POCKET.

A billiard and pool table pocket in which the chalk cannot be broken by the striking of the balls is shown in the accompanying illustrations, where Figs. 1 and 2 represent the pocket unattached and in position on the table, and Fig. 3 shows the blank for making the body of the pocket. These pockets are preferably made of leather colored green, to correspond with the cloth on the table. It will be seen that the blank is so formed that its lower end strips may be contracted and folded over a ring to give the proper shape to the pocket, the ring leaving an opening to allow the chalk to pass through, but affording a seat to receive the ball. Attached to this ring is also an additional or lower pocket, of netting, to receive and hold the chalk in such separate compartment.

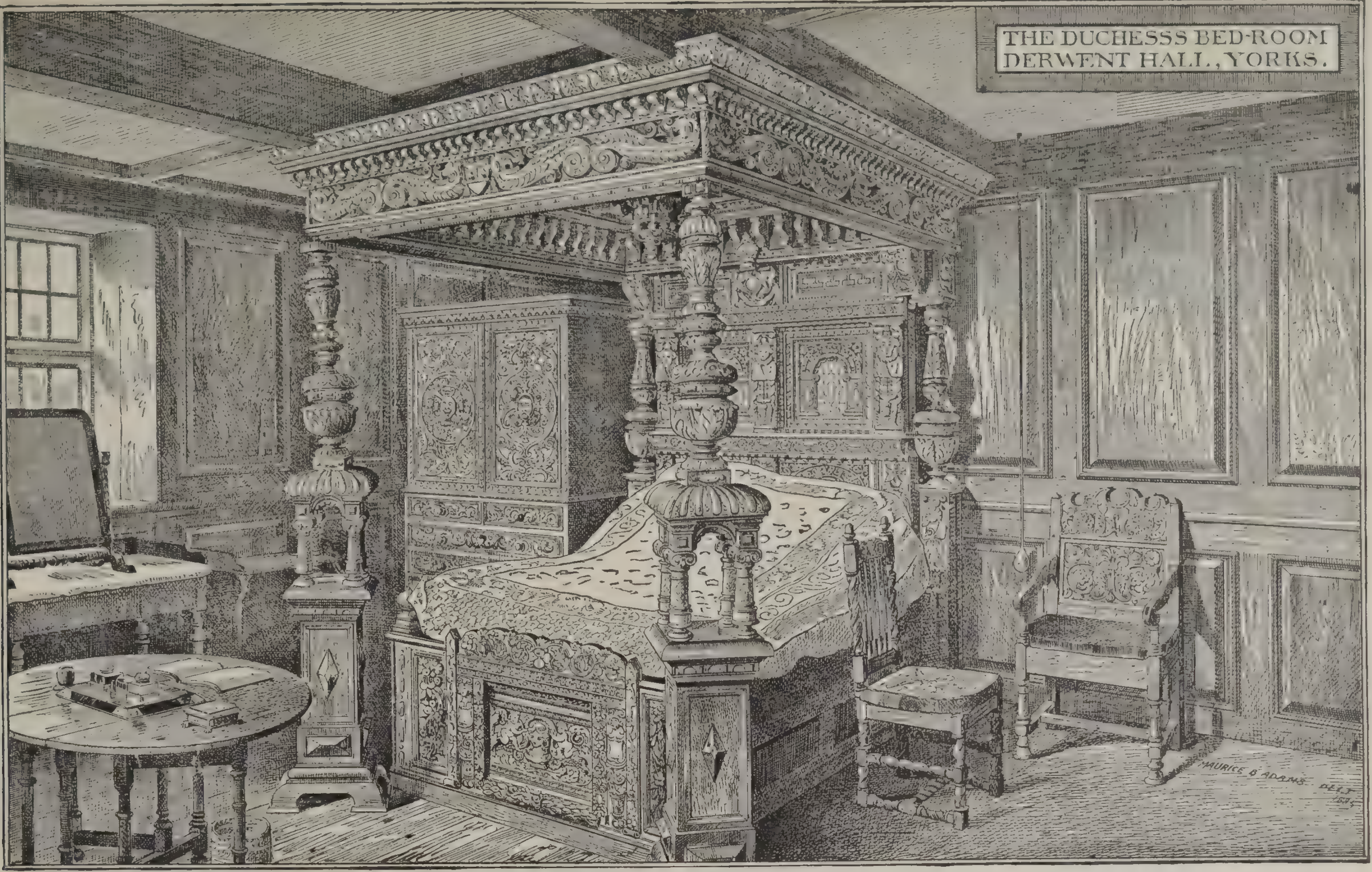
This invention has been patented, and the pockets are manufactured, by Mr. David W. Seely, of No. 118 Lake Street, Elmira, N. Y.

OXYGENATED water, or peroxide of hydrogen, for bleaching, is being manufactured in England in a concentrated condition, and sold at the rate of 5¾ d. per pound, in quantities not less than one carboy.

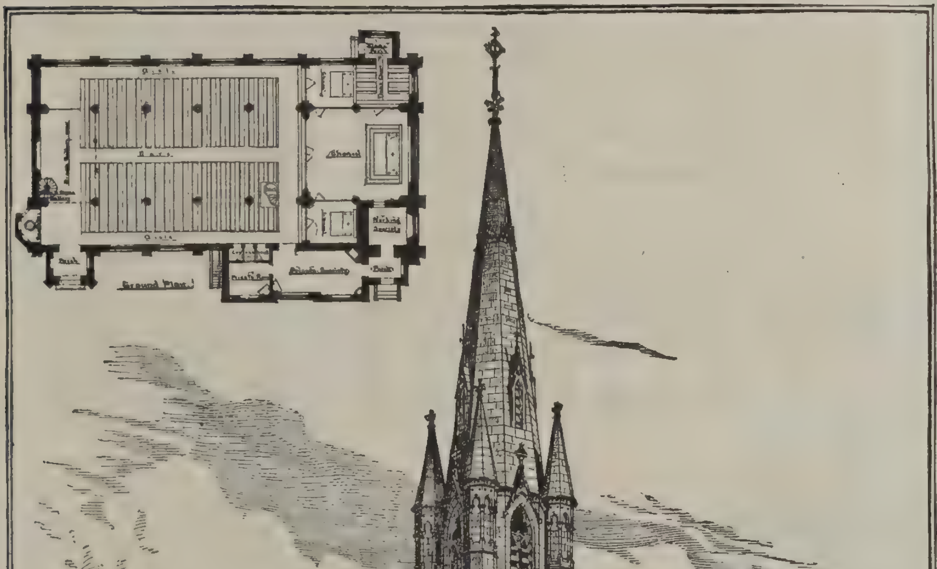


THE TEMPLE OF DIANA AT EPHESUS, RESTORED BY JAMES FERGUSSON, F. R. S.—[See page 56.]

Drawn by R Green



THE DUCHESS'S BEDROOM.—[See page 56.]



SUGGESTIONS IN CHURCH ARCHITECTURE.—[See page 56.]

THE HELICOIDAL OR WIRE STONE SAW.

THE sides of solid bodies, whatever be the degree of hardness, and however fine the texture, possess surfaces formed of a succession of projections and depressions. When two bodies are in contact, these projections and indentations fit into one another, and the adherence that results is proportional to the degree of roughness of the surfaces. If, by a more or less energetic mechanical action, we move one of the bodies with respect to the other, we shall produce, according as the action overcomes cohesion, more or less disintegration of the bodies. The resulting wear in each of them will evidently be inversely proportional to its hardness and the nature of its surface; and it will vary, besides, with the pressure exerted between the surfaces and the velocity of the mechanical action. We may say, then, that the wear resulting from rubbing two bodies against each other is a function of their degree of hardness, of the extent and state of their surface, of the pressure, of the velocity, and of the time.

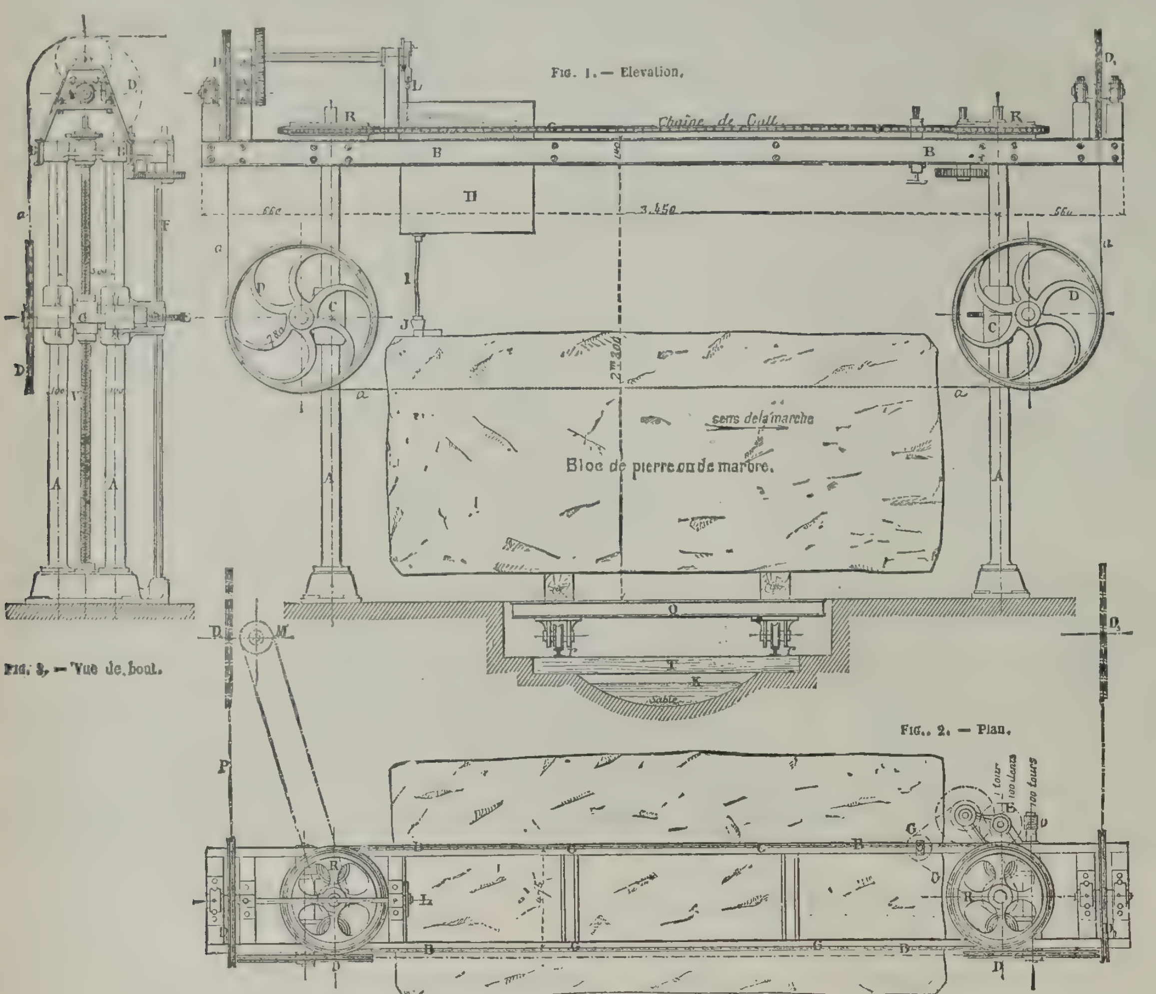
According as these factors are varied in a sense favorable or unfavorable to their proper action, we obtain variations in the final erosion. Thus, in rubbing together two bodies of different hardness and nature of surface, we obtain a wear inversely proportional to the hardness and state of polish of their surfaces. Through the interposition of a pulverized hard body we can still further accelerate such wear, as a consequence of the rapid renewal of the disintegrating element.

The gradual wear effected over the entire surface of a body brings about a polish, while that effected along a line or at some one point determines a cleavage or an aperture.

The process usually employed in quarries or stone-yards for sawing consists in slowly moving a stone-saw backward and forward, either by hand or machinery, and with scarcely any pressure. Mr. P. Gay has, however, devised a new process, which is based upon the theoretical considerations given above. His *helicoidal saw* is, in reality, an endless cable formed by twisting together three steel wires in such a way as to give the spirals quite an elongated pitch.

The apparatus in its form for cutting blocks of stone into large slabs (Figs. 1, 2, and 3) consists of two frames, A A, five feet apart, each formed of two iron columns, 7½ feet in height and one foot apart, fixed to cast iron bases resting upon masonry. At the upper part, a frame, B B, formed of double T-irons cross-braced here and there, supports a transmission composed of gear-wheels, R R, and a pitch-chain, G G. Along the columns of the frame, which serve as guides, move two kinds of pulley-carriers, C C. The pulleys, D D, are channeled, and receive the cable, *a a*, which serves as a helicoidal saw. The direction of the saw's motion is indicated by the arrow. The carriages, C C, are traversed by screws, V V, which are fixed between the columns. The extremity, *v*, of the axle of the pulley to the right is threaded, and actuates a helicoidal wheel, E, which transmits motion to the wheel, R, through the intermedium of the vertical shaft, F. This transmission, completed by the wheels, R R, and the pitch-chains, G G, is designed to move the saw vertically, through the simultaneous shifting of the carriages, C C. A tension weight, P, through the intermedium of pulleys D_1 D_1, permits of keeping the saw taut. A reservoir, H, at the upper part of the frame, B B, contains the water and sand necessary for sawing. The feeding is effected by means of a rubber tube, I, terminating in a flattened rose, J, which is situated over the aperture made by the saw. A small pump, L, over the reservoir takes water from K, and raises it to H. The sand is put in by hand.

Above the basin, K, a system of rails and ties supports the carriage, Q, upon which is placed the block of stone to be sawn. When one operation has been finished, and it is desired to begin another, it is necessary to raise the pulley-carriers and the saw. In order to do this quickly, there is provided a special transmission, M, which is actuated by hand, through a winch.



FIGS. 1, 2 AND 3.—APPARATUS FOR SAWING STONE.

The work done by this saw is effected more rapidly than by the ordinary processes, and certain very hard rocks, usually regarded as almost intractable, can be sawed at the rate of from one to one and a half inches per hour.

For sawing marble into slabs of all thicknesses, the arrangement described above may be replaced by a system consisting of two drums having several channels to receive as many saws, or two corresponding series of channeled pulleys, *b b* (Fig. 4), independent of each other, but keyed to the same axles, *i i*. When the pulleys have been properly spaced by means of keys, the whole affair is rendered solid by a bolt, *g*. The extremity of the axles forms a nut into which pass vertical screws, *c c*. These latter are connected above with cone-wheels, *l l*, which, gearing with bevel wheels keyed to the shafts, *e*, secure a complete interdependence of the whole. The ascending motion, which is controlled by the endless screws, *f*, and the helicoidal wheels, *m*, is in this way effected with great regularity. Uprights, *a a*, of double T-iron, fixed to joists, *k k*, and connected and braced by pieces, *d d*, form a strong frame.

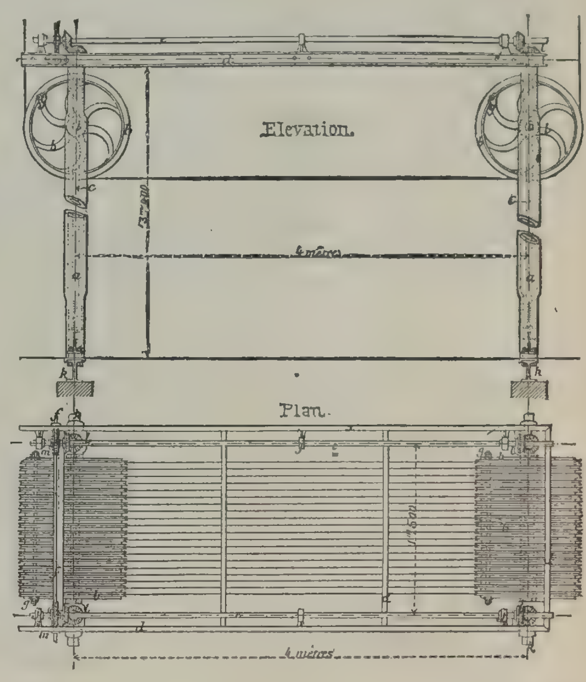


FIG. 4.—APPARATUS FOR SAWING STONE INTO SLABS.

The power necessary to run this kind of saw is less than $n \times \frac{1}{4}$ H. P., on account of the number of passive parts. The most interesting application of the helicoidal saw is in the exploitation of quarries. Fig. 5 represents a Belgian marble quarry which is being worked by Mr. Gay's method.

Tubular Perforators.—Mr. Gay has rendered his saw completer by the invention of a tubular perforator for drilling the preliminary well. It is based upon the same principle as the Leschot rotary drill, but differs from that in its extremity being simply of tempered steel instead of being set with black diamonds. A special product, called metallic agglomerate, is used instead of sand for hastening the work.

The apparatus, Fig. 6, consists of an iron plate cylinder, A, 27½ inches in diameter, and of variable length, according to the depth to be obtained, and terminating beneath in a steel head, B, of greater thickness. This cylinder is traversed by a shaft, C, to which it is keyed, and which passes through the center of the aperture drilled. This shaft is connected with the cylinder, A, through the intermedium of cross-bars, D, and transmits thereto a rapid rotary motion, which is received at the upper part from a telodynamic wire that passes through the channel of the horizontal pulley, P. This latter is supported by a frame consisting of three uprights, Q Q, strengthened by stays, R R, fixed to the ground.

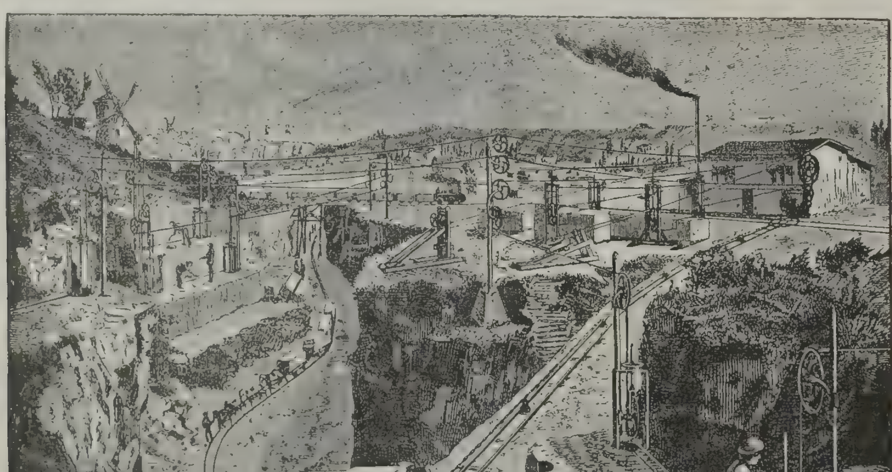


FIG. 5.—APPLICATION OF GAY'S STONE SAW IN A MARBLE QUARRY.

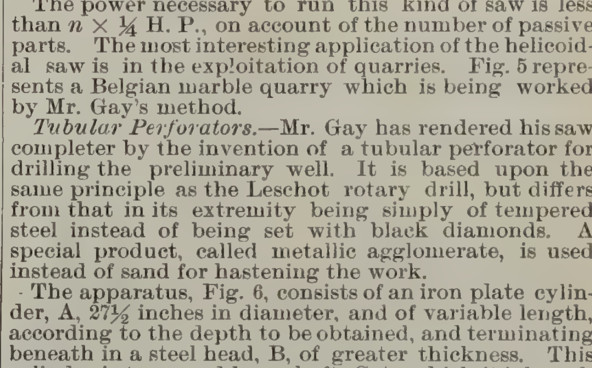


FIG. 6.—TUBULAR PERFORATOR.

In order that the cylinder, A, may be given a vertical motion, cords, M M, fixed to a piece, S, loose on the hub, D, wind round the drum of a windlass, T, after passing over the pulleys, *p p*.

The rapid gyratory motion of the cylinder, along with the erosive action of the metallic agglomerate, rapidly wears away the rock, and causes the descent of the perforator. During this operation a core of marble forms in the cylinder. This is detached by lateral pressure, and is capable of being utilized. The tool descends at the rate of from 20 to 24 inches per hour, or from 8 to 10 yards per day in ordinary lime rock.—*Le Genie Civil.*

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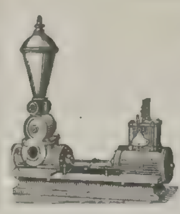

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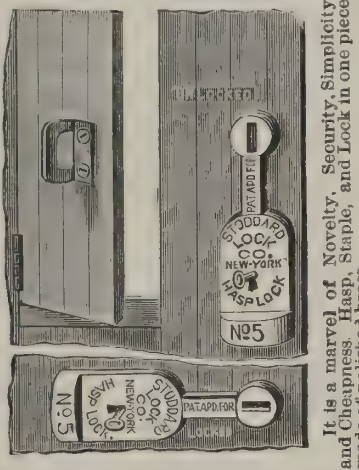

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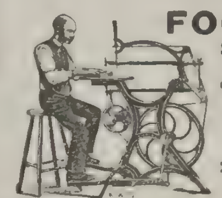

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THE TEMPLE OF DIANA AT EPHESUS.

The restoration of the temple of Diana at Ephesus, of which we present our readers with an illustration on page 52, is based wholly on the discoveries made by Mr. J. T. Wood during the excavations on the site between the years 1863–1874. The temple was apparently first thrown down by an earthquake in early Christian times, and since that period has served as a quarry and limekiln for successive cities on the spot, till very little indeed remained of it when Mr. Wood discovered its site and the remains buried under an accumulation of 20 feet of mud and sand washed down from the neighboring hills. Though the remains were, consequently, scant, they were fortunately such, when combined with the accounts of it left by the ancients, as enabled the plan and form of the temple to be made out with very tolerable certainty.

The peristyle of the temple consisted of the unusual number of 127 Ionic columns, each 60 feet in height, disposed so as to form an exceptionally widely spaced octastyle in front, the extreme awkwardness of which was remedied by the introduction of 9 columns in the rear and 24 on the flanks, counting the angle ones twice. Thirty-six of these columns, we are told by Pliny, were "celatæ," which from the examples brought home by Mr. Wood we now understand to mean adorned with a range of sculptured figures, about life-size, encircling them above the base; but, from the fragments brought home and now in the British Museum, we learn that a certain number of these—probably half the number—were mounted on square pedestals, as shown in the restoration, which must have added very considerably to their richness and artistic effect.

Besides these sources of magnificence, Mr. Wood discovered that the temple was placed on a podium or stylobate raised about 10 feet above the pavement of the surrounding courtyard, forming what Pliny calls the "universum templum," 425 feet in length by 220 feet in breadth. If this was adorned with sculptures, as we know that the podium of the altar at Pergamus was, it must have added very considerably to the grandeur of the temple; and, if adorned with groups of sculpture and candelabra, and other ornaments suggested in the drawing, must have rendered the temple not only the largest (which it certainly was), but the richest, existing in ancient times, and worthy to be ranked as one of the seven wonders of the world.—*The Building News.*

DUCHESS'S BEDROOM.

Derwent Hall, belonging to the Duke of Norfolk, is situated near Sheffield, and the work a few years ago carried out there was done under the direction of Mr. J. F. Hansom, the architect. Our present sketch, on page 53, shows the apartment known as the "Duchess' Bedroom," celebrated for its magnificent bedstead of elaborated Jacobean workmanship, while the other furniture of the room is also very good in style and equally interesting.

This bed, however, is an uncommonly fine one, more particularly on account of its beautiful detached posts or columns supporting the very rich canopy or tester. The foot board, too, is specially refined and elegant in the detail of its ornamentation, almost Italian in some of its carvings. The well-known beds at the King's Arms Tavern, Lancaster (figured in the "John o' Gaunt Sketch-Book"), are in some ways like it; and in connection with them are the bedsteads still to be seen at Hampton Court, Hatfield and Hardwick Halls, as well as at Wroxton Abbey, Oxfordshire. Abroad, instances crowd on the memory of high beds and wonderfully carved bedsteads, particularly those of the time of Francis I. Several have caryatides for posts, as in the bedroom of Diana de Poictiers at Chenonceaux, where the bedstead has a solid box carved plinth on all sides; and at the foot, over the cornice and draped frieze, occurs a rather curiously treated semicircular pediment quite in character with the style. At Azay le Rideau is another bed of the same type, but more elaborate and less admirable. These both contrast more favorably with each other than they do with our present Old English piece of work from Yorkshire, which, though so rich in style, has a quiet, homely dignity about it. In the center of the ceiling is a pendant enriched with brackets and fleur de lis, while in the middle of the bed's head over the arched paneling occurs a ducal coronet, shaped something like a miter, above a heraldic shield and ribbon. The ceiling is coffered, and the frieze has grotesque beasts carved upon it, rather later, probably, in date than the constructive parts.

Our drawing of the Derwent Hall Bed is based upon a photograph. The illustration also shows the old folding table and carved chairs, together with the elaborately inlaid wardrobe which stands next the bed.—*Building News.*

ST. MARY'S (R. C.) CHURCH, LEEK, STAFFORDSHIRE.

We give on page 53 views of the design for the above church, prepared by Mr. Albert Vicars, Somerset Chambers, 151 Strand, London, for the Rev. Alfred M. Sperling. The foundation stone was laid on the 15th inst. by the Right Rev. Edward Ilsley, D.D., Bishop Auxiliary of Birmingham. The edifice is already erected some feet higher than the church floor level, which is about 10 ft. above the street, and will be in the decorated style of architecture. The plan consists of nave and two aisles, chancel (arranged for surpliced choir), two side chapels, baptistery, confessional, recessed in wall of aisle, opening into a small room, for priests, fitted with a fireplace; nuns' choir for the use of the adjoining convent; priest's sacristy, with heating chamber under; and working sacristy, surmounted by a very effective tower and spire 140 ft. high. The organ gallery is at the west end; the chancel and side chapels at the west end. The interior length of the chapel is 104 ft. long by 50 ft. wide, and the height to the apex of the barrel roof ceiling of the nave and chancel will be 53 ft. 6 in. The exterior elevation of the roof from floor to ridge is to be 64 ft. The columns and responds of nave and chancel arcading, the shafts supporting principals of roof, also the exterior shafts, columns, and bands on spire, will be of red Scotch stone. The rock-faced ashlar is to be of local Hazelhurst stone, and the dressings of Doulting stone. Messrs. Barker & Son, of Birmingham, are the contractors, and Mr. Peter Shaw the clerk of works.—*Building News.*

Patents.

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ENGINEERING INVENTIONS.

A railroad rail spike forms the subject of two patents issued to Mr. Thomas A. Davies, of New York city. According to one of the patents, the heads are laterally inclined upon their lower sides, to give them a substantial bearing upon the flanges of the rails when the spikes are driven into the ties in an inclined direction. The other provides for the head of the spike having its lower part in the form of a frustum of a cone, with its axis at right angles with the axis of the spike body, to give a firm bearing on the rail flanges whether the spikes are driven vertically or not.

A stay plate for railroad rail spikes has also been patented by the same inventor. Combined with the rails, ties, and spikes are tapered plates, of a width greater than that of the spikes, driven into the ties at the outer sides of the spikes, and transversely with the grain of the wood, to hold the spikes firmly in place against the rail flanges, and prevent the rails having any lateral movement.

A center fastening for railroad rails, likewise patented by the same inventor, provides for recesses in the edges of opposite flanges of the rail, in which are driven inclined fastening spikes, at opposite inclinations on opposite sides of the rail, such improvement being especially applicable on single track railways, to resist the tendency of the rails to creep in either direction.

MISCELLANEOUS INVENTIONS.

A tool handle has been patented by Mr. Frank Cronin, of Deming, New Mexico. This invention covers a double ratchet mechanism, made for easy adjustment, to allow rotation of the bit in either direction, and is intended for use with all sorts of hand tools requiring a rotary motion.

A machine for sewing looped fabrics has been patented by Mr. Joseph M. Merrow, of Merrow, Conn. This invention relates to machines for uniting parts of stockings or other knit work, and covers an attachment whereby the thread that unites several articles is cut automatically instead of by hand.

A hand saw has been patented by Mr. Alfred Fornander, of Brooklyn, N. Y. Combined with a stock or handle are a straining bar and cam lever, for locking the straining bar on the stock or handle, to facilitate placing and securing saw blades of various sizes in the frame, the improvement being especially applicable for hack saws and butchers' saws.

An insect destroyer has been patented by Mr. Dudley H. Manning, of Sibley, Iowa. Combined with an inverted conical ring holding a frame with a lamp within it and a transparent shade around the lamp are reflectors, and a conical hood above the lamp, the apparatus being placed on the top of a pail or other vessel partly filled with water, which is thus illuminated and attracts insects.

An endless band or cord has been patented by Mr. Leedham Binns, of Philadelphia, Pa. It is tubular plaited, united at its ends by each of the ends being inserted bodily and longitudinally in reverse direction to each other within the portion of the body of the band next adjacent to the other end, being specially designed for driving the spindles of spinning machines and other machinery.

A loom shuttle has been patented by Mr. Charles N. Newcomb, of Omaha, Neb. It is designed especially for rag carpet looms, and has tension regulating springs projecting into its eye, with a rag receiving can having an open end adapted to be placed within the shuttle body, the can holding a large quantity of rags and delivering the weft with a light and uniform tension, without twisting.

A windwheel has been patented by Mr. Franklin G. Tallerday, of Poplar Grove, Ill. Its wings are made of sail cloth or similar material, in a suitable frame to be expansible and contractible, and the construction is such that the wind, acting upon the concave part of the wing, opens it to its fullest capacity, and when blowing on the convex surface closes the fan or wing part way down.

A bicycle has been patented by Mr. Selden A. Jan Graw, of Nashua, N. H. This invention covers a novel construction of parts and details in a bicycle whose speed can be regulated as desired by changing the proportional sizes of toothed wheels which transmit the power, and which has a safety attachment to prevent headers or the tilting of the bicycle.

A metallic sole for boots or shoes has been patented by Mr. William T. Milholland, of McKeesport, Pa. It has closed hollow projections on its outer face, such projections being struck from the body of the metal of the plate, so as to inclose air spaces on the sole when applied, and the plates being fastened on by nails or screws, making boots or shoes well adapted for mill men or others having to walk over hot floors.

A permutation lock has been patented by Mr. Walter E. Malley, of New Haven, Conn. Combined with a casing, sliding bolt, and sliding tumbler are ratchet wheels adapted to engage with the tumbler, and push pins or other devices for turning the ratchet wheels, the latter being held in place by pawl springs which can be disengaged from the wheels, making a lock that is simple, safe, and not liable to get out of order.

A shoulder brace has been patented by Messrs. William Carroll and John Meekison, of Columbus, Ohio. Besides the usual features of a shoulder brace, the straps are connected with wires or cords made to extend down to each heel, where there is, in the hollow boot heel, a spring, rack, and pinion, which operate to make a pull on the brace to hold the shoulders back when the weight of the body is resting on the feet.

A wool washing machine has been patented by Mr. James E. Sinclair, of Waverly, Md. This invention covers improvements in a former patented machine of the same inventor, the machine having a series of connected receptacles in which the wool is successively treated, the receptacles being combined with one or more pumps for elevating the wool and water, and elevators for returning the water to the place from whence it was drawn.

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NEW BOOKS AND PUBLICATIONS.

ELEMENTS OF INORGANIC CHEMISTRY, DESCRIPTIVE AND QUALITATIVE. By James H. Shepard. Boston: D. C. Heath & Co., 1885.

There is a marked tendency at present to make all education subjective. From the youngest baby who toddles to a kindergarten to the college senior nearing graduation, the successive steps are taken as far as possible by the student himself, and both text book and teacher become subordinate to his own faculties. In many respects the system is advantageous. The studies appear more absorbing than when viewed impersonally. There is, however, a danger that in limiting the investigation to one's own experience, the broader view of the subject, the underlying theory, may be lost. Mr. Shepard has recognized these tendencies, and in the present volume has attempted to avoid the disadvantages of too strict an adherence to either theory or practice by combining laboratory work with text book instruction from the very beginning. Systematic, experimental, and analytical chemistry are thus united in one volume, and are intended to be taught side by side. The method is unusual, for a student is seldom admitted to the laboratory until he has acquired some knowledge of elementary chemistry. It is well presented, and with a careful instructor could be expected to give good results. The grouping of the elements is made according to the reactions, as in strict analytical works, and arsenic and antimony find place therefore among the metals. The work has had the advantage of a careful revision by Dr. Ira Remsen.

PITTSBURG AND WESTERN PENNSYLVANIA. Issued by the Chamber of Commerce of Pittsburg, 1885.

Of late years, when rival towns are pressing their advantages upon the attention of manufacturers, a custom has grown up, among the various Chambers of Commerce of the competing points, of issuing pamphlets descriptive of the merits of their respective towns. It is a very good custom; for though these local bodies perhaps see more of the rose color about the smoke of the home atmosphere than other people would, their corporate standing is a guarantee of the integrity of the statements made; they offer also a convenient medium for further correspondence. The present brochure is a good example of its kind. A description is given of the main industries of Pittsburg and the natural facilities which aid their development, particular attention being of course devoted to the question of natural gas. An excellent map, showing the position of the oil fields and main gas wells, accompanies the monograph.

Natural gas: its advantages, use, and economies, by George H. Thurston, is a similar monograph having Tarentum as the subject of its eulogies. It is put forward evidently by the borough, and makes a strong appeal to the prospecting capitalist. Those investigating the economic advantages of Western Pennsylvania will find both of these pamphlets of interest.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

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(1) C. C. B. asks: Do you know of any remedy to prevent horses from wind or stump sucking and weaving? A. Both of the troubles mentioned by you are habits, and therefore not curable by any treatment other than care. The sucking habit may be prevented by tying a piece of sheepskin, woolly side out, over the posts, or by tying something around his throat to prevent swallowing. The other habit is incurable.

(2) S. R. asks for a receipt for making German paste for canary birds, small quantity. A. Blanched sweet almonds one pound, pea meal two pounds, butter three ounces, saffron a few grains, honey a sufficient quantity. Form the whole into a paste, and granulate it by pressing it through a colander. Some add the yolks of two eggs.

(3) J. C. H. writes: 1. When I add tincture of cantharides to Horsford's acid phosphate, the mixture becomes cloudy. What are the reactions? A. The alcoholic extractive matter, insoluble in water, is naturally precipitated by the addition of an acid aqueous solution. 2. Is the phosphorus precipitated? A. The phosphorus is therefore not thrown down. 3. Are the medicinal properties of the ingredients changed? A. Not unless the extractive matter, which is precipitated, is removed, and also it depends upon what the compound is given for, whether it is impaired.

(4) H. W. H., Jr., writes: Some time ago I saw a very good method of assay of gold, a short process producing the metal from the ore to the pure state. Kindly say where I may find it. A. The detection of gold in a given mineral is a simple process, but the assay involves a determination of the amount of gold in the ore, and can only be satisfactorily accomplished by the collection of the metal in a lead button and subsequent cupellation of the same, as described in all text-books on the subject.

(5) H. M. asks (1) for means of restoring to its previous condition a painting done on white velvet, which was soiled by smoke, etc. A. We do not think that it is possible to remove the smoke without injury to the painting. 2. The method of cleaning steel engravings? A. Articles on "How to Restore Soiled Steel Engravings" are given in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 44, 115, and 124.

(6) C. M. McK. asks how will vulcanite a little less hard than that used for combs, brushes, etc., compare, under pretty rough treatment, with leather in durability? A. The vulcanite will not stand "pretty rough treatment." 2. About what proportion of sulphur would be used to obtain such a quality of vulcanite? A. For details as to manufacture see SCIENTIFIC AMERICAN SUPPLEMENT, No. 252. 3. Can you give me some idea of the cost of vulcanite in large quantities? A. The value of vulcanite is dependent upon its quality, and the price in accordance is from 30 cents to 75 cents.

(7) E. H. R. asks if the "white bronze" monuments retain their original color for an indefinite length of time. A. Yes. 2. Is the expansion or contraction of the metal by reason of heat or cold such as to be material, or worthy of consideration? A. No. 3. Does the white bronze, which I understand is zinc, wear well? A. Yes, it is very enduring. 4. My reasons for inquiry is, we are about getting up a soldiers' monument, and we want a good one. A. White bronze is excellent for the purpose you mention.

(8) J. H. asks the names of the ingredients composing the liquids in the various patent fire extinguishers, or a formula for a good liquid for the same. A. 8 pounds carbonate of soda, 4 pounds alum, 3 pounds borax, 1 pound carbonate of potash, and 24 pounds silicate of soda solution are mixed together; 1⅛ pounds of this mixture is added to each gallon of water when required for use. See also answer to query 7 in SCIENTIFIC AMERICAN for February 7, 1885.

(9) W. W. A. asks: Can I keep ice successfully with sawdust in a room 6 feet square and 8 feet high? The bottom is 6 feet below the ground, and is well drained. How thick should the sawdust be around it? A. Your plan is feasible. A layer of sawdust from 6 to 8 inches between double wood walls will be quite sufficient.

(10) H. L. K. asks (1) how sugar coated popcorn is prepared after the corn has been popped. A. The adhesive mixture with which the corns are held together consists of gelatine with a little molasses; the coloring matter is carmine.—We cannot undertake to give examples in simple arithmetic in these columns.

(11) F. E. asks: 1. Is there any book giving full information in regard to the manner of removing hair by electricity? A. There is no single book treating on this subject, and the practical success of this method can hardly be called proved. See the articles on Removal of Hair by Electricity contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 176 and 353. 2. Are there irido-platinum needles, manufactured for this purpose? A. No. 3. Is a one cell battery sufficient? A. No. 4. How is turtle shell softened, so that it may be given any desired shape? A. It is softened by the heat of boiling water; and if compressed in this state by screws in iron or brass moulds, till it may be bent into any shape, the moulds being then plunged into cold water.

(12) J. W. V. asks: Is there any difference between the so-called "compound oxygen" used by some of the doctors, and the oxygen obtained by heating potassium chlorate and manganese? A. "Compound oxygen" is simply a fancy name given to an article made and sold by various physicians throughout the country. In the May issue of the *Druggists Circular*, the analyses of five articles bearing the name of compound oxygen are given. 2. Is the latter ever used for medicinal purposes? A. Under certain circumstances, it is probably used for inhalation. 3. How are paper mustard plasters made? A. They are probably made by dipping porous paper in a strong alcoholic extract of oil of mustard. After it has dried, it may be applied.

(13) C. R. C. writes: An eight day clock spring ⅜ inch in width would be equal to a weight of how many pounds as to power? A. Clock springs are not always of the same power for the same width. You can only ascertain by trial of a given spring.

(14) E. C. & J. E. Y.—For stove cement use pulverized clay 8 parts, fine iron filings 4 parts, peroxide of manganese 2 parts, sea salt 1 part, borax 1 part. Thoroughly pulverize, dry, and mix. When required for use, make up the required quantity for immediate use into a thick putty with water.

(15) C. E. A. asks the simplest way to melt small quantities of gold, silver, copper, etc., also if platinum can be melted in the same manner. A. The simplest method of melting gold, silver, copper, etc., is by treating them with a little carbonate of soda on a piece of charcoal, and then fusing with a blowpipe. Platinum requires a much higher heat, and is infusible by the ordinary processes.

(16) B. writes: I can buy a good second hand portable 12 horse power boiler and engine for the same price I can a 5 horse power of same style. I wish to put an engine in my barn for steam purposes generally, such as cutting forage, firewood, etc., but do not need over 5 horse power. Which of these two engines is preferable for me? Will the 12 horse power be as economical as the five horse power in doing the same work? In my inexperience, it appears that a 12 horse engine doing half work is as economical as a 5 horse power at its full power. Is it? A. We recommend the 12 horse power engine, which will do your work at half the boiler pressure; and, if your boiler is in proportion, will not only give you economical results, but will be a source of satisfaction if you should afterward need more power or wish to sell.

(17) M. C. C. asks: What chemical is used in annealing malleable iron castings, and in what proportion? A. Pulverized hematite or pulverized anvil scales. The goods to be packed in cast iron boxes so that each piece shall be surrounded with the above material. The whole to be placed in an oven and heated red hot, and remain so for from 2 to 4 days.

(18) G. M.—The bluing of gun barrels is done by heating evenly in a muffle until the desired blue color is raised—the barrel being first made clean and bright with emery cloth, leaving no marks of grease or dirt upon the barrel when the bluing takes place. We do not recommend this except in the hands of experts. It requires considerable experience to obtain an even, clear blue. The receipt for browning is from the United States Ordnance Manual, and is as follows: Spirits of wine 1½ ounces, tincture of steel 1½ ounces, corrosive sublimate 1½ ounces, sweet spirits of niter 1½ ounces, blue vitriol 1 ounce, nitric acid ¾ ounce. Mix, and dissolve in 1 quart of warm water, and keep in a glass jar. Clean the barrel well with caustic soda water to remove grease or oil. Then clean the surface of all stains and marks, by emery paper or cloth, so as to produce an even bright surface for the acid to act upon. No finger marks. Stop the bore and vent with wooden plugs. Then apply the above mixture to every part with a sponge or rag, expose to the air for twenty-four hours. Then rub the loose rust off with a steel scratch brush. Again apply the mixture and scratch brush, and if not perfect, a third time. If satisfactory, wash in boiling water, dry quickly, and wipe with linseed oil or varnish with shellac.

(19) R. G. W. asks (1) how to gold, silver, and nickel plate small things. I have a powerful battery of zinc and carbon and sulphuric acid and bichromate of potash. A. For information on electroplating we refer you to SUPPLEMENT, No. 310. You will not require a battery giving a high tension current for electroplating. 2. Which can be burnt the harder—a hard pressed brick or one that is not pressed very hard? A. So far as the hardening of the clay is concerned, one brick will be as hard as the other; but the pressed brick will be more dense, and will consequently stand more pressure.

(20) F. R. H. asks: Will you give me in your valuable paper a little advice as to the use of melted paraffine as a means of protecting metal (tools, implements, etc.) from rust, damp, and salt air? Here in Florida I have great trouble with such things as guns, carpenters' tools, machinery, and hardware in the house rusting, and have heard a good deal of talk about paraffine. A. You can obtain paraffine from any of the wholesale druggists in New York city, who will give you prices on application. It comes in irregular fragments or in cakes; you can apply it to the metal surfaces by warming the metal and rubbing the paraffine on, allowing it to melt, or you can dissolve the paraffine in benzole or naphtha, and apply it as a varnish.

(21) D. G. E. asks: Why will a long horsehair stretched in an Æolian harp produce a sound, when a shorter one, blown upon with a current of air from the mouth, will not? Are there any peculiar conditions in which strings produce sounds by such means? A. There is no reason why the Æolian harp effect cannot be produced by the breath, if the conditions are favorable; probably one reason why you did not succeed in your experiment is that your string was so short as to produce vibrations too rapid for a musical note.

(22) J. B. S. writes: Please send me the directions for using the Reis telephone, or let me know in what number of your paper, if in any, I can find an explanation of the same. A. Reis' telephone may be used successfully by substituting carbon for the platinum points. It may be made to transmit speech by a careful adjustment of the platinum points, but it is not practical when used in that way. Some experimenters have placed between the contact points of the transmitter a liquid such as acidulated water, thereby improving the effect. For description of Reis' telephone, see SUPPLEMENT, No. 389.

(23) F. A. H. writes: To-day a man came in my office with a small glass tube with two round globes on each end, each as large as an egg. The tube connecting the two bulbs was some 8 or 10 inches in length. They were about half full of a red, blood-looking fluid. By holding one bulb in the hand, for some persons, the fluid would rush to the other bulb, although the other bulb was much higher than the one in hand; for others, the fluid would not move. It was claimed by the man that had it that it was operated by the blood; a person having good blood would cause it to flow almost perpendicular into the upper chamber, while a person with poor blood would not move it. As I had never seen anything of the kind before, I was much surprised. Will you kindly explain in Notes and Queries the science of this instrument, what the fluid is, and why it operates? A. The tube and bulbs contain ether colored by aniline. The air is exhausted from the bulbs, so that the ether boils at a very low temperature, the heat of the hand being sufficient to vaporize it rapidly. The quality of the blood of the person handling the instrument has nothing whatever to do with the action of the ether.

(24) R. L. asks: 1. Would not brass wire do for winding field magnets of electric machine described in SUPPLEMENT, No. 161? A. Brass wire will not answer so well as copper wire, because its electrical conductivity is considerably less than that of copper. 2. Would not paper covered wire do? A. Paper covered wire would do, provided you could wind it without breaking the insulation. The paper covering should be very thin and strong. 3. What would machine be worth complete? A. Such machines may be purchased for from $40.00 to $50.00.

COMMUNICATIONS RECEIVED.

On Clinical Thermometers. By C. E. W.
On the Fly's Foot. By C. H. L.

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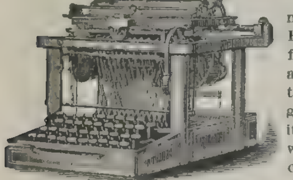

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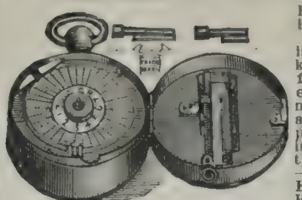

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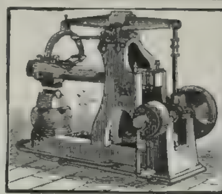

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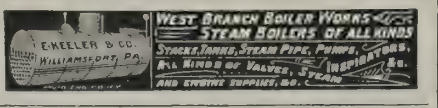

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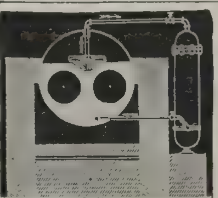

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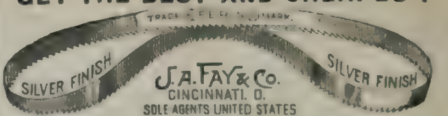

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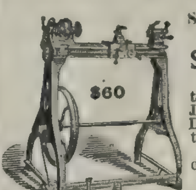

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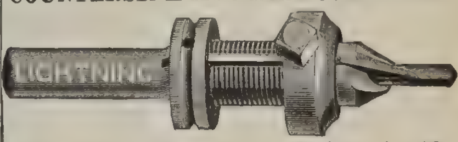

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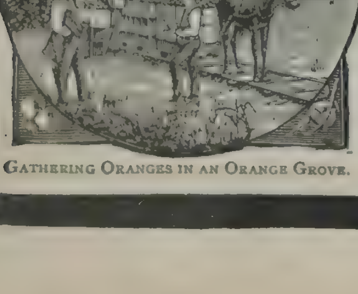
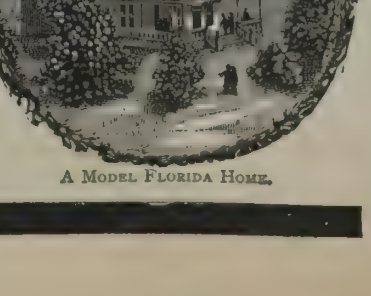


Gathering Oranges in an Orange Grove.



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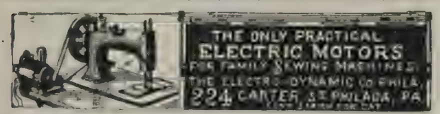

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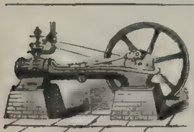

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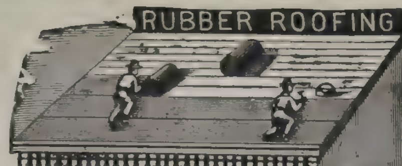

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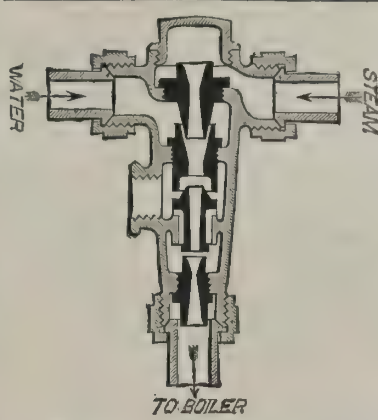

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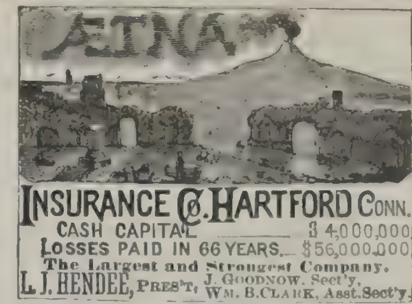

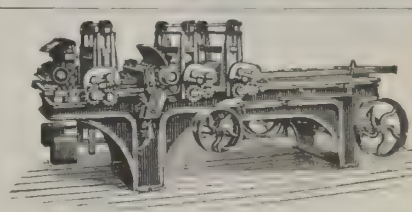

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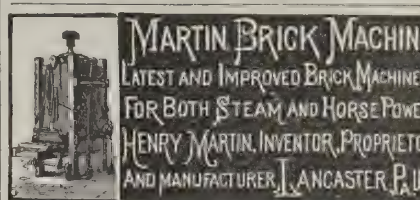

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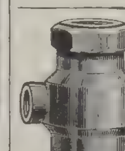

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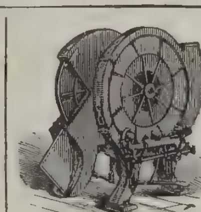

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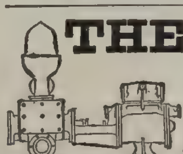

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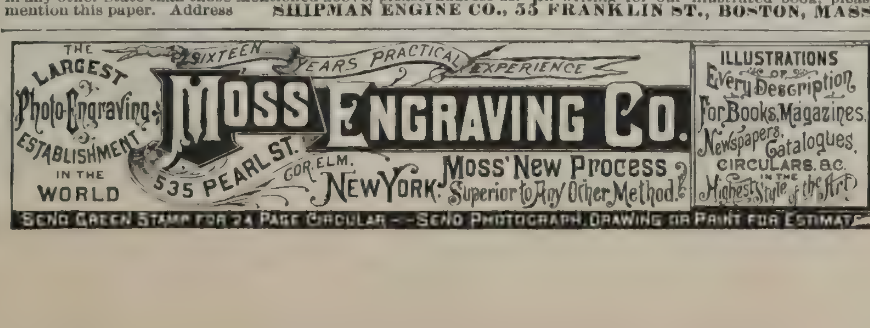

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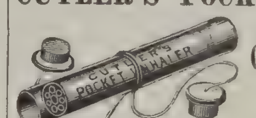

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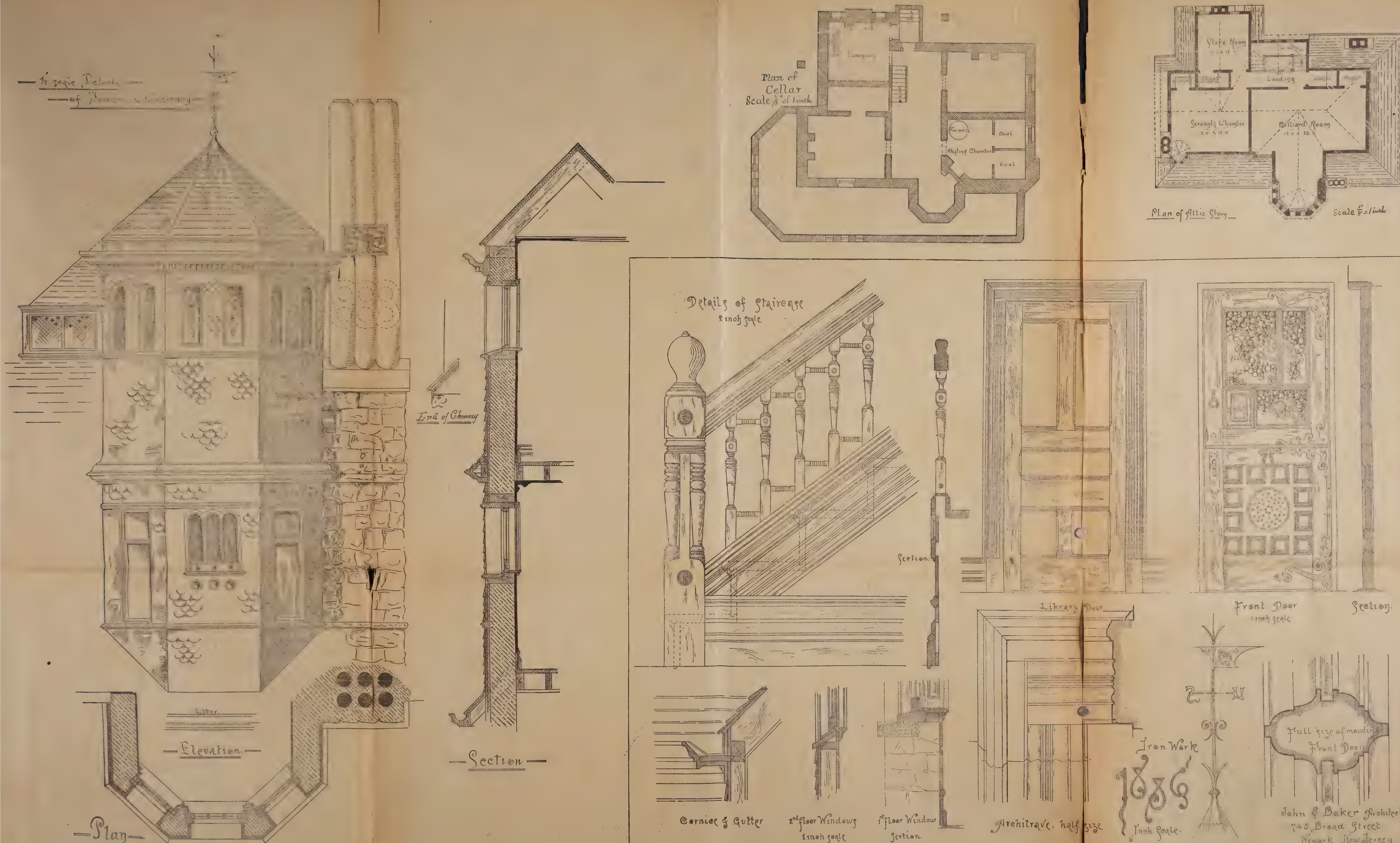
Classified Index of Advertisements Contained in the Present Number of the Scientific American, Architects and Builders Edition.



Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for December, 1885.

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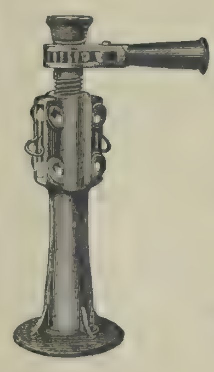

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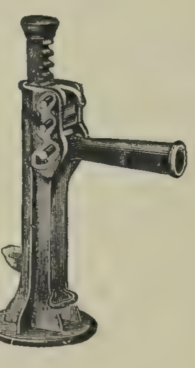

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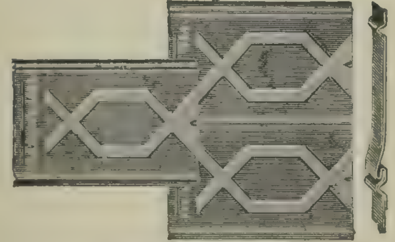

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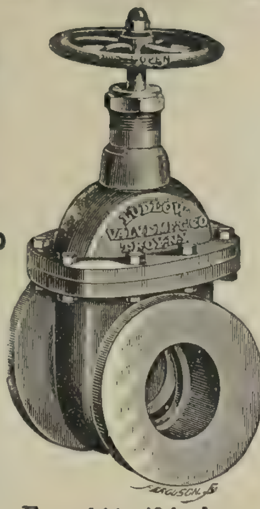

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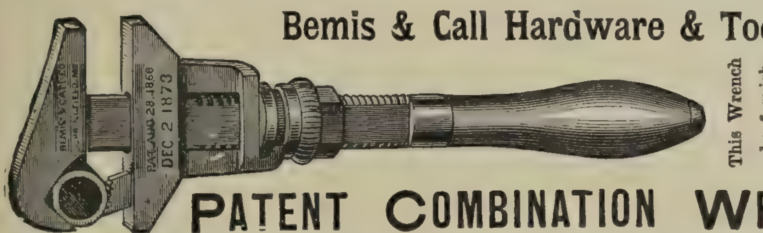

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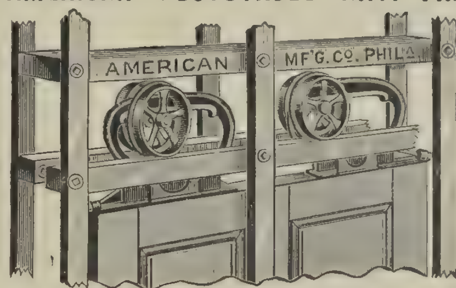

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Vol. I. Subscription, $1.50 a Year. NEW YORK, JANUARY, 1886. Single Copies, 15 Cents. No. 3.

NEW YORK FIRE DEPARTMENT TESTING DEVICES FOR THROWING LIFE LINES OVER BUILDINGS.

UNEXPLORED BRANCH OF THE FIRE ESCAPE PROBLEM.

It would seem as if the subject of fire escapes had been thoroughly explored in all its branches when we look at the various contrivances which ornament the walls of many of the buildings in this city, when we remember the appliances placed at the disposal of tenants by the aid of which they can make their own descent, and when we see the machines for reaching, from the ground, those caught within a burning building. Permanent fire escapes, while admirably answering the purpose, cannot be placed upon every building in a great city, neither can they be located so as to be within access of all the windows; a fire in the line of the escape practically cuts off all the adjoining windows, and though such a case is extremely rare, it comes within the range of those possibilities which should be carefully eliminated when dealing with this problem People will not, and cannot be compelled to keep private fire escapes—mainly ropes or chains and flexible ladders and tubes—within easy reach. They know the advantage of having a rope handy in case of fire, but they do not feel the necessity, since they have never been taught by actual experience—the only school that will vividly impress upon people's minds a dread of fire, and will make them take proper precautions. Machines operated from the ground—the most common kind being the several forms of extension ladders—are impracticable in this city, mainly because of the telegraph wires, the strength and great number of which in almost every street effectually prevent raising the ladders. With this obstacle removed we would still have the time necessarily consumed by them in reaching the fire.

Since the burning of the SCIENTIFIC AMERICAN offices in January, 1882, the Fire Department of this city has been looking for some device by means of which any person caught in the upper stories of a burning building could be rescued. To further this idea, about one year ago inventors of appliances for throwing a cord or small line over the roof or into any selected window of a building were invited to exhibit their machines to the authorities. Recently a second test was made at the foot of the Palisades, as shown in our frontispiece. The object of these trials is to obtain an apparatus which will, without fail, raise a small cord to the roof of the highest building in this city, and if it will carry a line into any particular window, so much the better. Of course, the cord once over the cornice of the building, it is easy for those on the ground to bring it within reach of an individual in one of the upper windows, when a heavy or life line, attached to it, may be raised.

The appliances shown in the lower view used powder to throw rockets, to throw projectiles from a cannon or rifle, and compressed air to throw a projectile. To the lower end of each missile was attached the end of a cord which played out as the missile rose in the air. No device was presented using an elastic substance, such as metallic springs, wood, or rubber.

Mr. Benj. F. Morris, of Hook and Ladder Company 15, exhibited a device for throwing a rocket, consisting of a brass barrel 3½ feet long, and having a bore large enough to easily admit the rocket, and mounted upon extension tripod legs, two pivoted a short distance back from the muzzle, and one pivoted to the rear extremity; by this means the device could be rapidly adjusted so as to discharge the rocket at any desired elevation. The rocket was fired by a cap placed at a point about in the middle of the barrel.

Mr. R. MacDonald, of 109 Liberty Street, showed a rifle having a bore about 2 inches in diameter, and rifled. The head of the missile, which somewhat resembled a winged dart, was spirally grooved, the shaft was of small size, and the tail was provided with side wings and with circular disks closely fitting the bore. A small charge of gunpowder was used. The rifle was rested against the shoulder and aimed, as shown in the second figure in the engraving.

The air gun, shown in the central figure, was designed by Mr. Otto Regl, of the Fire Department Repair Shops. The lower portion of the gun formed the air reservoir. and was provided at its upper end with a pressure gauge indicating up to 300 pounds. A channel led from the upper end to a rubber cushioned valve, the stem of which projected a short distance beyond the exterior. Screwing into the upper side of the valve was a barrel, which, when not in use, was strapped to the side of the reservoir. Pivoted by a catch pin in jaws placed just above the end of the valve stem was a curved lever. When the gun is not in use, this lever is so pivoted that the stem enters a concave part of the curve, and the handle may be pressed down close to the cylinder without opening the valve. When the gun is to be used, the position of the lever is reversed, so that a slight downward movement of the handle brings the convex part of the curve in contact with the stem, which is pushed in, thereby opening the valve and allowing the compressed air to rush into the barrel. The projectile was conical in shape at its forward end, and was hollow at the rear; across the hollow portion extended a bar, to which was pivoted a short rod which rested snugly in a groove cut in the side of the projectile. The string was secured to the end of this rod, and passed out at the muzzle. The reservoir is charged by a pump, and at 300 pounds will throw three shots. It is provided with a coupling by which, if the air should give out when the gun is needed, it could be connected with the ordinary extinguishers carried by the hook and ladder trucks, the pressure in which would be amply sufficient.

Mr. Francis J. Gray, of Engine House 18, showed a contrivance for discharging a rocket. Placed between two inverted conical-shaped cord holders was a wooden trough to hold the rocket. The frame carrying the holders and groove was pivoted between two standards projecting from the base; this arrangement permitted the elevation to be changed as desired. In all the rocket throwing devices a short length of wire was placed next the rocket, the cord being attached to the free end of the wire.

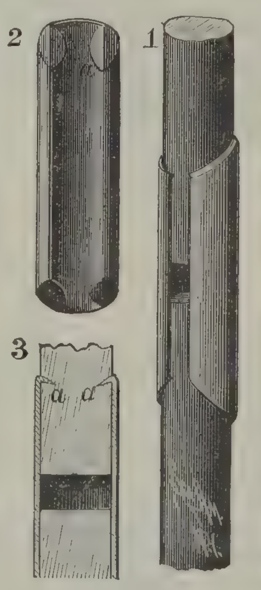
The cannon was shown by Mr. Patrick Ryan, of Engine House 25. The projectile was long, extending a little beyond the muzzle when in the gun. A longitudinal recess extended from the rear end nearly to the front of the projectile. Closely fitted within this groove was a bar, the rear end of which was pivoted, and the forward end formed with an eye, in which the cord was tied. When the projectile left the gun, the bar swung around and assumed a position parallel with the forward portion. The sighting device is shown beside the gun. One rod of the sight fitted the bore of the gun, and the sight was taken along the other rod, which by means of the connecting piece was a short distance above the gun barrel.

With these devices, which we have so briefly described, lines varying from 200 to nearly 700 feet in length were extended up the face of the cliff. None of them failed.

As near as we can ascertain, the Fire Department is in search of a device which must be of the simplest construction, must be easy to handle and control, must be unaffected by the weather, must be of comparatively light weight, and must be absolutely reliable in operation under all conditions. It must be able to easily raise a line to the roof of the highest buildings, and it ought to be capable of being aimed so as to surely reach a window at any elevation. Although New York city has taken the initiative in this branch of the fire escape problem, such a device, if acceptable here, would be quickly appreciated in every city of any size. The problem has been proposed; it now awaits solution.

BELT FASTENER.

The invention herewith illustrated, lately patented by Mr. Lewis W. Herrick, of Edmore, Mich., belongs to that class of belt fasteners formed of a piece of sheet metal having inwardly projecting teeth on its ends, which are forced into the ends of the belt by dies. The fastening clip, Fig. 2, is made in tubular form, with one side left open to allow of the insertion of the belt. The ends of the clip are inclined from the closed side toward the open side, and the edges of these portions are bent toward the center of the clip to form penetrating projections, *a*. The purpose of rounding the edges is to allow the ends of the belt while being inserted or withdrawn to slightly spring the projections apart, to allow of the easy entrance or withdrawal of the belt ends without the use of tools of any kind. When the end of the belt is being inserted, it will first bear against the outer rounded part of the projections, then ride up the incline until it strikes against the closed side of the clip. It will be seen that both ends are so secured that any strain put on the belt will only tend to force the ends of the belt further up the inclined projections. There will be no tendency of the belt ends to come out of the open side of the clip, and the strain will not tend to force the sides of the clip apart.



An Assyrian Statue of 850 B. C.

About twenty-five years ago there was shipped to a gentleman in Philadelphia, from a missionary to Syria, a life size statue of a king, taken from the ruins of Nineveh at the time of Sir Henry Layard's explorations. It had been lost by a caravan in the desert, and when received was stored and neglected, until a few days since. It represents a king clad in royal robes, bearing in one hand a basket and in the other a fir cone, a portion of the stone being covered with sharply cut hieroglyphics, which Assyrian scholars are now endeavoring to translate. The statue came from the temple of King Assur-nazir-pal, a famous conqueror who reigned from 883 to 859 B. C., and who was, therefore, sleeping in his grave when Nebuchadnezzar, King of Babylon, was yet an infant.

Correspondence.

Mr. A. R. Bennett's Improved Voltaic Cell.

To the Editor of the Scientific American:

My attention has been called to the article entitled "A Cheap Battery," in your issue of April 11, which describes the voltaic cell invented by me.

The battery is now extensively used in this country, especially for telephone transmitter work. Some telephone exchange systems use no other. The experience thus gained has led to the improvement of the battery in some respects, especially in regard to the form of the zinc plate. Such a plate as is depicted in your illustration is liable to be quickly eaten through at the water line, whether the cell works or not. Zinc rods are subject to the same destructive action when they are partly in and partly out of the solution. The zinc is now placed entirely under the surface of the solution, and a brass wire, covered with rubber tubing, brought up from it for the purpose of forming the connection. This wire is soldered into a deep hole drilled in the zinc. The tubing is then slipped down the wire until it reaches the bottom of the hole, which is then filled up with melted sulphur. When this is properly done, the zinc is eaten away only in proportion to the work performed by the battery. The zinc should always be amalgamated. The rubber should cover the wire well beyond the surface of the solution. The solution should be always caustic potash, as caustic soda creeps up and makes a very dirty cell. When the battery is intended for permanent work, the outer pot should be of cast iron. This is no better electrically, but lapped and soldered pots are not trustworthy for a long period. For long continued use the porous pot should not be less than 6x3½ inches, and the charge should be 6 ounces of caustic potash. The battery may be made to give a much stronger current—equal to 2 volts—by mixing 1 ounce of permanganate of potash with the iron borings, and filling them up with the caustic potash solution. It should be noted that unless permanganate of potash is used, no caustic potash solution is put with the borings, except what filters through the porous pot.

A. R. BENNETT.

Popular Errors Concerning Health.

Professor George H. Rohe, of the College of Physicians and Surgeons, Baltimore, in a recent lecture on "Some Popular Errors Concerning Health and its Preservation," quoted the saying, "One man's meat is another's poison," and showed that, while idiosyncrasies with regard to certain articles of food or medicines do exist, they are far less frequent than is generally believed. Articles of food which ordinarily disagree may be better borne if differently cooked. A more serious error is that one should rise from the table hungry. The sensation of hunger is a cry of the tissues for food, and should always be appeased. Much of the ill-health of brain workers is due to a lack of sufficient food. It is impossible to lay down hard rules as to the quantity of food one should eat, but the remarks of the old country doctor who had lived in good health, doing hard work until fourscore and ten, might be taken as examples: "I have always eaten when I wanted to eat, as much as I wanted, and the best food I could get." Another fallacy is, that all diseases are due to disturbances of digestion. Graham bread, oatmeal, cracked wheat, etc., are more difficult of digestion than pure wheat bread.

It is a dangerous error to withhold cold drinks from persons sick with fever. It is cruel, objectless, and the dangers that are said to follow it are imaginary. The effects of alcohol upon the body were discussed at some length, and the conclusion drawn that alcohol does not supply heat to the body, but rather withdraws it. The greatest danger to the man who gets dead drunk in cold weather is that he may freeze to death. The use of alcoholic drinks in health is injurious, but its medicinal use is valuable in many instances. The notion that we should not bathe while overheated is as unreasonable as it is widespread, but persons should not remain in the bath long enough to become chilled. The traditional axiom that boils are an evidence of good health is a snare and a delusion. Prof. Rohe said: "For my own part, I should prefer to be without that sort of health. Even Job, when suffering from an abundant crop, could not gain consolation from his would-be comforters."

That vaccination does not prevent smallpox is a very dangerous error, but that it is preventive of other diseases is equally a fallacy. Statistics prove that before the introduction of vaccination deaths annually from smallpox numbered nearly 3,000 for every million inhabitants. Since the practice has become general the percentage of deaths has fallen to about one-tenth of the former number. Without vaccination the deaths from smallpox in this country would be 150,000 a year. Vaccination has not increased other diseases. That any one remedy is a cure for all diseases that afflict humanity is an absurdity. While hydropathy and electropathy are unquestionably of benefit in some diseases, they cannot be relied upon for the cure of all.

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ARCHITECTS AND BUILDERS EDITION.

This is a Special Trade Edition of THE SCIENTIFIC AMERICAN, issued Monthly,—on the first Saturday of the month.

It goes directly *into the hands of those who have the ordering of the great bulk of Building Materials and Appliances*, namely, the Architects, Builders, Constructing Engineers, and Contractors.

It has the largest circulation of any Architectural or Building paper in the world.

An Increase of Trade will necessarily accrue to all Manufacturers and Dealers whose establishments are conspicuously represented in this important edition of THE SCIENTIFIC AMERICAN.

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Of the January number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT No. 522,

For the Week Ending January 2, 1886.

Price 10 cents. For sale at this Office and by all Newsdealers.

ABOUT TERRA COTTA.

Terra cotta must now be regarded as a staple building material. The stage of experimenting is past, and the manufacturer is sure of his work and of the market. The architects and builders of our large cities are well acquainted with terra cotta, but to many others a concise account of this material and of the point to be observed in its use may not be unwelcome.

Terra cotta, like brick, is burnt clay. There is no patent composition about it, as many might suppose from its name. It was known to the ancients, as many discovered fragments from old ruins, and numerous literary references, testify. To make good terra cotta, the clay must be rich in natural silica and free from carbonaceous and sulphurous material and from grit. Soft, loamy clays, which require the addition of sand to make them fit for burning, are more suitable for common bricks and for stoneware pottery. A fine, even, plastic texture is necessary for terra cotta. Hard clays require to be crushed and pulverized, and all are greatly benefited by exposure to the oxidizing action of the air. The leading makers now employ expensive and special machinery, suitable to the particular clay at their command, so as to secure a perfect paste. Clays fit for terra cotta appear to be found in abundance in every country, at varying depth below the ground. The coloring matter is oxide of iron, and the color varies according to the quantity of this chemical, the degree of burning, the fuel, and the construction of the kiln. It ranges from a warm buff through every shade of red to a rich brown, and can be regulated at will.

The most ordinary way to shape terra cotta is to press the prepared clay into moulds from wood or plaster models or patterns. This is an important part of the business, similar in most respects to the pattern making in iron foundries. Allowance must be made for the shrinkage of the clay in drying and burning. It is best for architects to allow the manufacturer to arrange for this himself.

All terra cotta blocks above the smallest dimensions are modeled hollow, with suitable solid sides or ends, and sometimes partitions to give the necessary strength. By this method a nearly even thickness of clay is attained, varying from one to three inches, seldom more. Solid lumps of material are thus avoided, the baking takes place evenly and simultaneously all around and all through the clay, and cracking and warping are considerably reduced. This tendency of the clay to warp, twist, and crack under fire is the greatest difficulty the manufacturer has to contend with.

Not only must each maker suit the manner of burning to the nature of the clay he uses, but the same material seems to behave in an erratic manner under apparently identical conditions. Different patterns of kilns are used—square and round, down-draught and up-draught, muffled kilns, where the flame does not come in direct contact with the clay, and open ones, in which it does.

A perfect kiln is the great desideratum of terra cotta manufacture, and experience alone must guide each maker toward this desirable achievement. The preparation of the paste has almost reached perfection; the kiln and also the fuel must be suited to this to insure the best possible work. Vigilance and judgment on the part of the workmen intrusted with the burning process are of the utmost importance. For the foregoing reasons, architects should joint their lateral terra cotta work, such as belt courses, cornices, window sills, etc., in pieces not exceeding two feet in length, especially when they are of a flat section.

Before being dried, the moulded clay is thoroughly dried in rooms kept at a moderate temperature. The amount of exposure in the kiln varies from an ordinary red heat to a white heat sufficient to melt iron, all according to the nature of the clay, the depth of color desired, and the durability to be attained. All terra cotta should be well burned to be thoroughly hard and chemically and physically homogeneous; beyond this point further burning is of no advantage, as it only tends to make a brittle fabric, and increases the chances of warping.

Terra cotta is now used for every kind of architectural work, from the simple moulded brick to the most elaborate cornices. Entire fronts have been carried out in this material, and important constructive functions have been assigned to it. It is, however, an open question whether terra cotta should be used in this sense. Some recent failures seem to indicate the contrary. Although strong, it is not well to expose it to great weights and strains. Nor can it be said that elaborate continuous features, like, for instance, a modillion entablature or a fluted pilaster shaft, are of a thoroughly satisfactory appearance when viewed closely. From reasons already explained, the separate moulded pieces are too unequal to make perfect butt-joints and true continuous lines. Some cornices in New York city buildings have a distinct wavy outline, and much imperfect work seems to indicate that there is a tendency to strain this material to uses which are beyond its capabilities. The proper sphere of terra cotta is that of an auxiliary decorative and constructive material in connection with brick-work or stone masonry. Under such conditions its very imperfections are converted into points of merit. Terra cotta is used to best advantage in moulded bricks for the edges of door and window openings, in plinth and belt courses and cornices of modest projection, in moulded architrave blocks, keystones, tiles, panels, etc., for separate features or continuous friezes, in pilaster capitals, figured and ornamental subject panels, balusters, cappings, copings, chimney pots, in roof tiles and ridges, and other isolated ornamental features, also for fireplace mantels. A plain brick building may, with the means above indicated, be invested with artistic interest at a comparatively small cost, and elaborate and high art effects may be obtained with terra cotta at a cost much below that of convex masonry.

The bedding of the separate blocks is made to work in with ordinary brick bond; is either $2\frac{1}{4}$ inches, 4 inches, or 8 inches, and so on, according to the size of the block and the projection. They are built in with cement mortar like stonework, and are inclosed secure or held by superincumbent weights in the same manner as stonework of great projection is. The butt-jointing of terra cotta work is peculiar. For balustrade cappings and similar top courses of light section, where neither weight nor anchors can hold the work, it is well to dowel joint the pieces. For window sills, top courses of cornices, wall copings, etc., it is best to lap-joint the blocks, to protect the joint against wet and frost. This practice gives a very good effect when the joints occur regularly.

About cost it is difficult to give data of any value, unless accompanied by a precise description of the work understood. The illustrated catalogues of the leading manufacturers give full information.

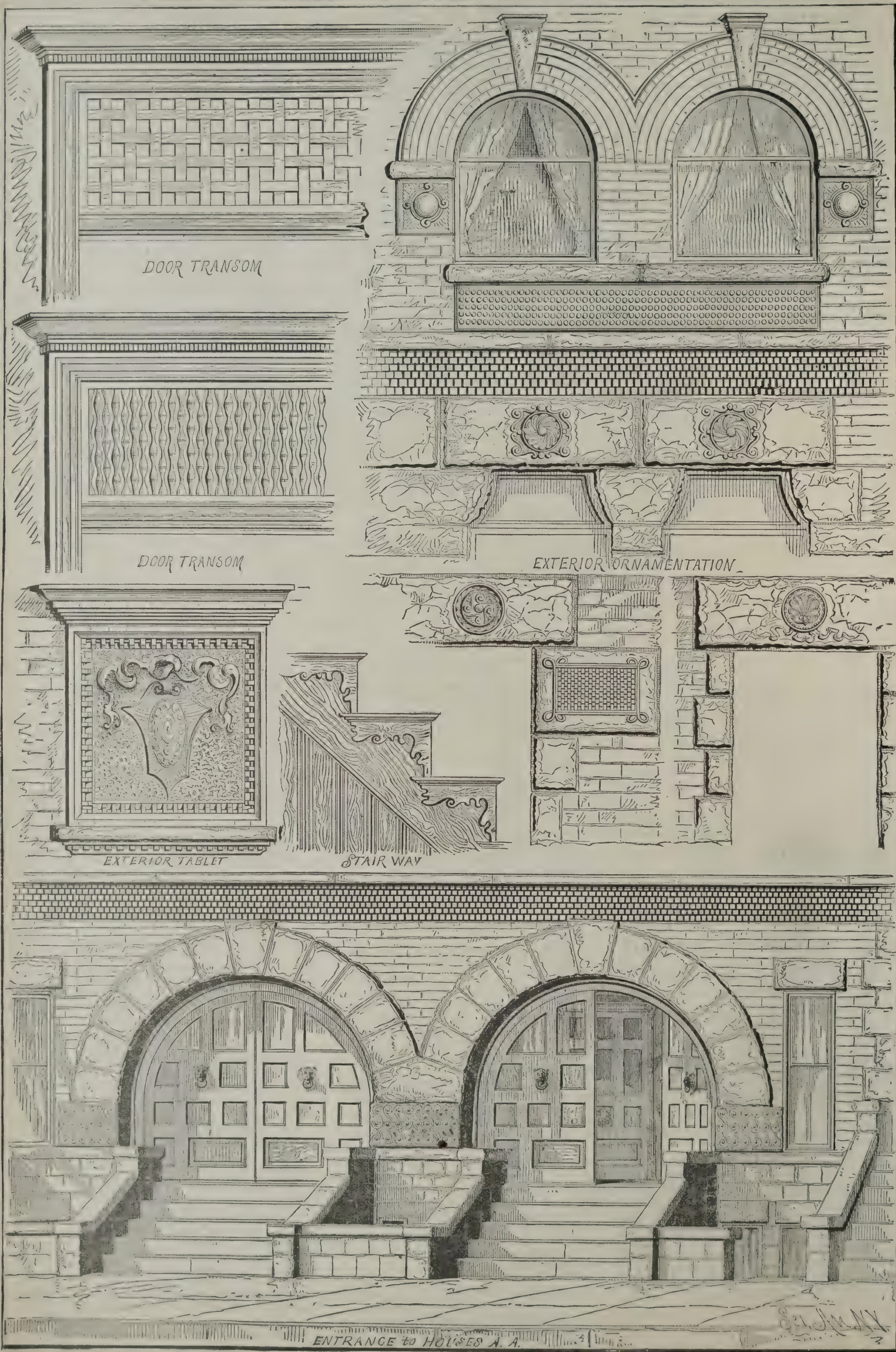
A most important point is to order terra cotta early enough in advance of the general estimate for a building. This will save much delay and annoyance. It is also well to order a reasonable surplus of bricks or tiles, to make up for any accidental breakage in transit or on the building. Every architect and builder should seek the opportunity of visiting the establishment of a terra cotta maker, to see for himself the various manipulations and the variety of the articles made and their diversified application. There is no other building industry that has made equally phenomenal strides in an equally short space of time.

Cast Iron Columns.

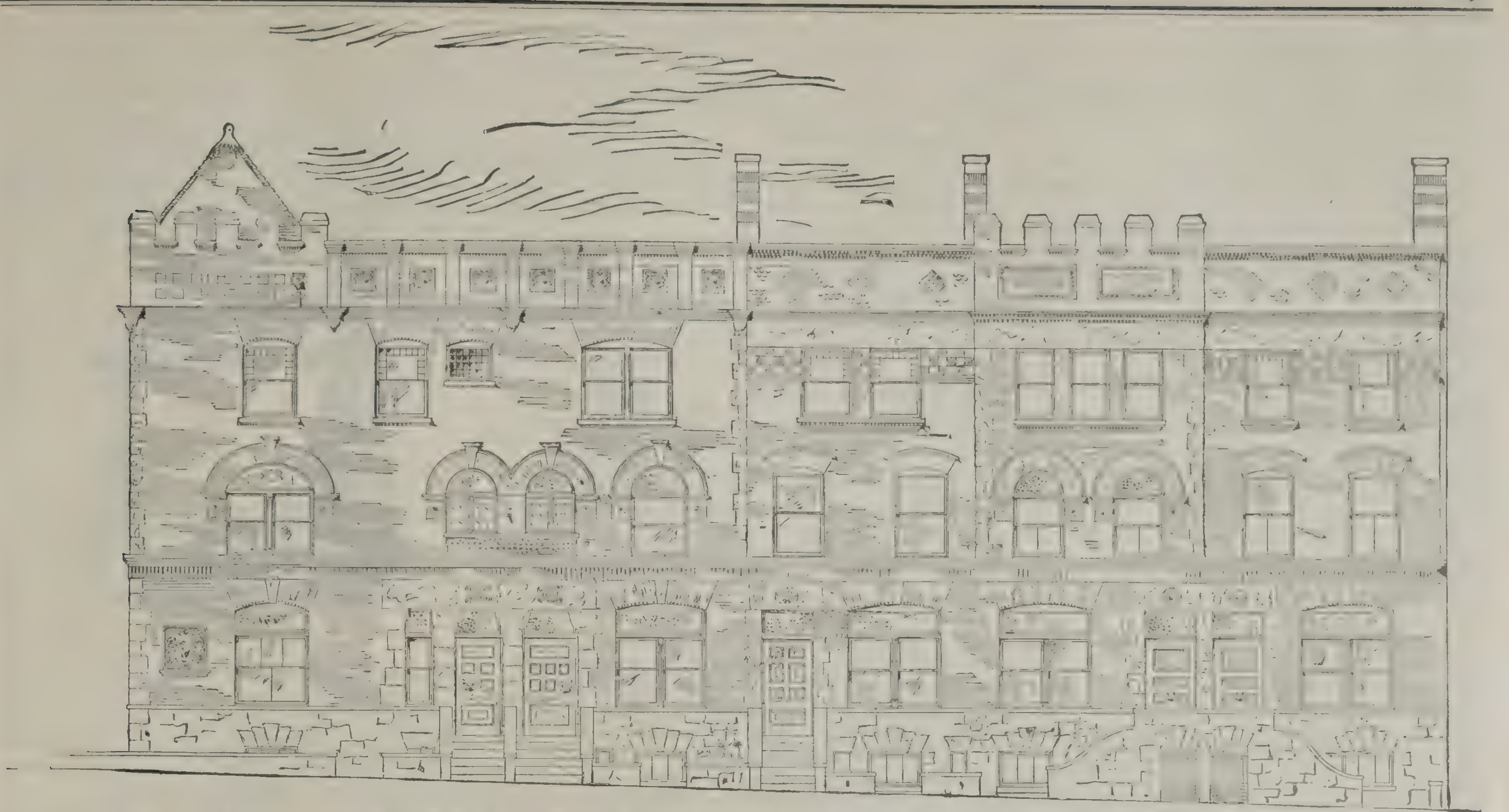
The design and execution of the columns of the Royal Bank, Dublin, was matter of the most anxious attention, on account of their unusual length, the great loads they were intended to carry, and the architectural necessity of diminishing their diameters to the utmost extent consistent with safety. The dimensions finally adopted were: Length, 26 feet; diameter of base, 14 inches; diameter of head, 12 inches; thickness of metal, $1\frac{1}{4}$ inches. The ultimate strength of this pillar, according to Hodgkinson's practical adaptation of Euler's formula, was 770 tons, and the safe load may be estimated at one-sixth of that amount.

Having decided the proportions of the column, it was of the utmost importance to secure good, sound casting, straightness, concentricity of bore to the external surface, and perfect bearing with flat ends on a good foundation. Soundness of casting and straightness were alone to be obtained by careful moulding and ventilation, but the certainty of obtaining uniformity of thickness required special precautions. It is well known that in moulding columns the hollow part is formed by means of a "core," composed of a perforated metal pipe, wrapped with hay and plastered with loam till it assumes the proper shape and size. This core is placed horizontally in the external mould, and held securely in the sand at both ends, "chaplets," or supports of tinned iron, being placed in addition at intervals throughout its length. These chaplets answer very well for small castings, as the sand of the external mould into which they are stuck has sufficient power to resist the distorting action of the molten metal; but in columns of such length as those here described, they would not be sufficiently secure to be trusted. It was necessary, therefore, to make a metallic connection between the top and the bottom boxes of the mould and the metal core barrel.

The strength of a column is very much influenced by the perfection of its bearing and fixity of its ends, and to insure these the ends of the columns were turned truly in the lathe; and the base, which was 2 feet square 3 inches thick, was turned on the upper and planed on the lower face. The foundation stone having been set perfectly level and chiseled to fit the plate exactly, the latter was laid truly in its place, and secured by means of iron dowels run with lead. The upper face of the plate being level, the column when reared on it was, of course, quite vertical, and in absolute contact with the plate all around. The cap, which is also turned on its under side, was slipped in between the beam and the column, and the space between it and the beam filled with bars of flat iron, and cast iron cement tightly driven in. Both the cap and base had projections a quarter inch high entering the column to prevent any lateral displacement.—*William Anderson, in the Architect.*



DETAILS—HOUSES 74TH ST. AND 11TH AVENUE, NEW YORK.—LAMB & RICH, ARCHITECTS.



HOUSES CORNER SEVENTY-FOURTH STREET AND WEST END AVENUE, NEW YORK.—LAMB & RICH, ARCHITECTS.

A BLOCK OF CITY HOUSES.

Our colored plate for this present month of January illustrates a block of recently constructed New York city dwellings of moderate sizes, showing the latest styles. These dwellings are by Lamb & Rich, the well known architects of New York, authors of many superior designs. The buildings we illustrate sell complete with the land for $12,000 and upward according to size. They are located in a very desirable part of the city, where land is advancing in value, and improved real estate is in demand. A walk of a couple of hundred yards or less from the front doors of the houses brings one directly into the magnificent grounds of the Riverside Park, which here extends along the banks of the Hudson River from 72d Street northward for a distance of over two miles.

In addition to our colored plate, we give a sheet of details showing the plans of the various floors; also a page engraving of ornamental details and an outline elevation of the 74th Street buildings.

They are built in the very best possible manner, with hard wood on the first floors, and all the best improvements for comfort and convenience.

Looking forward to future needs, wires are laid for electric lighting; the sanitary arrangements are of the best, and approved by the Health Board, and the heating so arranged that steam may be introduced if desired. The location is within five minutes' walk of the Elevated Railroads, and twenty-five minutes to City Hall; and by reason of the situation the opposite side of the avenue can never be built up, thus giving a view down upon the river.

Several of the houses are noticeable in their planning. In the houses marked A, one enters a large 15 ft. square hall with a hard wood floor and open fireplace. The vestibule is very large, and made beautiful by colored glass and an inlaid mosaic pavement. It is intended that this room shall be fitted up as a reception hall, such as is made the sitting room in many of our large country houses. Place herein a center table and an old English settle near the fireplace, and who could wish a better welcome home than the glowing embers of an open fire with such a surrounding and in such a hall? Looking toward the rear, through a large archway, the staircase is disclosed, of beautiful design, and running to the roof, where is a dome light of very large dimensions, and which throws its light down to the very first story hall—an unusual thing in our city houses. Back of this is a large room, that may be used either as the dining room or as a library, smoking room, or office, and through which the dumbwaiter runs to the next story above.

By this means either first or second floor may be used as the dining room. Above is the parlor, which is very large, and opening through the house to the library or dining room; above this are six sleeping rooms, with bath and a very large number of large closets, the pride of every woman. In these two houses a staircase leads to the roof, and it is intended that its surface may be laid out as in the old Venetian cities, where much of the time is spent upon the roof, with walks covered by awnings, with hammocks, vases with palm, orange, or lemon trees, and rustic seats.

If we take, again, the smallest house in this group, which will be found on West End Avenue next the corner house, a large tiled vestibule invites us to the first floor, where is the parlor opening through to the dining room, and a staircase both from the hall and from the butler's pantry, leading to the basement, while a closet in this hall is a luxury which few small houses enjoy. On the second floor are two large chambers, with every convenience of closets and bath room. Still above are four more chambers, large closets, and a trunk and store room. We venture to say that this house, though the smallest and least expensive, will afford many desirable comforts.

These are but a few of the many houses being built on the west side. On Seventy-first, Seventy-second, Seventy-fifth, Seventy-eighth, and in fact all along, they are springing up, and bid fair to make the whole neighborhood settled in point of good, artistic houses. Those given in our issue to-day are a representative group that may be obtained at the lowest price that a really first-class house can be built. We will now give a specification of the masonwork.

SPECIFICATION

of work to be done and materials to be furnished by mason in the erection and completion of six brick and stone dwelling houses for Lamb & Rich; situated on West End Avenue, 74th and 75th Sts.; built according to plans and specification prepared by Lamb & Rich, architects, 486 Broadway, New York city.

Plans.—Brick indicated by red; stone by brown; wood by yellow; iron by blue; terra cotta by T. All dimensions to be taken from figures, not scale.

Excavating.—Do the necessary excavating for cellars, areas, stoops, yards, foundations, trenches, drains, etc. To be sunk to depth as shown.

Workmanship and Materials.—All work to be done in a thorough and substantial manner throughout. All brick unless otherwise specified to be sound, hard burnt North River brick. All mortar for masonwork, excepting when specified cement, to be best quality of ground lime mixed with Rosendale cement in proportions of one part cement to two parts lime with proper proportions of clean, sharp sand, to make a strong mortar. All walls to be thoroughly grouted.

Footings and Foundations.—To be a footing course of concrete under all walls and piers, to be 10 inches thick, at least 8 inches wider on each side than the walls they support; to be sunk below cellar bottom according to sections drawn. The south wall of No. 6 to be sunk 10 ft. below grade. The cellar walls to be laid up with brick of thickness shown or with good building stone in cement mortar of thickness to conform to requirements of Building Department. To be well bonded in thorough manner. Lay up requisite foundations (of stone) for areas and stoops as drawn.

The whole of the exterior walls on fronts, where they come in contact with the soil, to be coated over with cement in thorough manner.

Brickwork.—Lay up brick walls of good quality sound, hard burnt North River brick of thicknesses shown on plans.

All basement and first story walls to be laid in cement mortar, all above basement in lime mortar.

Brick walls above first story window sills to second story belt course in street fronts to be faced up with Philadelphia pressed brick; remainder of fronts (also chimneys where they show in fronts) to be faced with selected first quality Colabar pressed brick of the deepest red made. The quoins around windows, also the arched window heads and all projecting surfaces (where of brick), to be faced with Philadelphia pressed brick. All faced brick to be laid in red mortar, with thin joints struck flush, and smooth rears, to be neatly laid up in good quality North River brick in red mortar, joints struck flush and smooth for painting. Windows to have strong arches turned over as drawn, with rowlocks, the large windows to have extra strong arches.

All arches or fronts with circular top to be laid up with rowlocks; where straight or level on top, to be cut to required shape. All to be as per elevations. Reveals to be four inches, as shown on plans.

Cleaning Fronts.—The fronts and all face brickwork to be cleaned down with aqua fortis, and oiled, extra care being taken to prevent staining stonework.

Moulded Brick.

Stonework.—The street fronts up to first story window sills to be faced up with Newark or Connecticut brownstone. Four inch ashlar backed up with brick. To be in courses of various sizes, with horizontal and vertical joints, laid in putty. Sills, sill courses, and cornice bands, caps, lintels, keys, quoins, etc., to be moulded or rock-faced as shown on elevations, and of thicknesses as shown or detailed. All these projections to have drip cut in soffit (to prevent washing on brickwork), *wherever possible.*

Tool-draught around openings and corners (only) in rock-faced work.

Walls of areas and stoops below sidewalk level to be faced up with rock-faced ashlar where exposed to view. Build stoop walls as drawn. Above steps to have ashlar eight inches thick, double-faced (to be in two thicknesses if preferred), coping on stoops to be five by ten inches, tooled on top with rock-faced edges. All steps and platforms to stoops and areas to be of brown stone, tooled neatly. The door steps to be beveled to act as saddle as well as sill.

Form the stone balcony in front of No. 4 house as drawn. To be securely fastened to building, and doweled together in strong manner. Form the stone arch over No. 5 doorway of rock-faced stone as drawn. To show a twelve inch soffit, to have carved springers and key as shown.

The door heads of Nos. 2, 3, 4, and 6 to have lintel ornamented by reeded work as drawn. Provide and set chimney caps on front chimneys of size as shown. Rock face to have holes cut in same for flues, to be well clamped together.

Furnish and set the front coping on party wall of No. 6 house as drawn.

Ventilating and Chimney Flues.—Build all flues as shown on plans; thoroughly point all the flues, both inside and outside, and leave same *perfectly free from obstructions* at the close of the works.

Chimneys to be carried up as shown on plans; each to have stone cap.

Every precaution possible to be taken to insure good draught. All first and second story flues, where so drawn, to be eight by twelve inches. Range flues are to be eight by sixteen inches where possible, with eight inch glazed pipe in same for smoke, surrounding space to be used for ventilation, with ten by twelve

inch register in kitchen and eight by ten inch in bath rooms. Furnace flues to have eight inch glazed pipe, where possible; where coming in twelve inch wall, to be five inch by twelve inch oval flue pipe.

Outside fireplaces to have two inch air space between outside wall and fireplace back.

Openings in Walls.—Leave openings or slots in walls, as shown on plans, for hot air and plumbing pipes, etc.

Fireplaces.—The jambs and recesses of kitchen and other fireplaces throughout to be laid up with first quality Philadelphia brick in red mortar, with thin joints struck flush.

Relieving Arches.—Turn relieving arches under all hearths and fireplaces and over all door and window openings and girders where necessary.

Cesspools.—Provide the necessary cesspools for yards and areas throughout.

Bluestone.—Parapet walls to be coped with 2½ inch × 14 inch coping, all in good lengths, well secured to walls. Furnish per set 12 inch bluestone lintels in rear, where shown, also 5 inch rough-axed sills to all rear openings.

Curb.—Furnish and set the necessary curb on streets, viz., about 300 feet, to be neatly axed.

All the above to be of good quality axed work, the top edge fine-axed, and all laid according to corporation ordinances.

Hearths.—Provide and lay rubbed bluestone hearths to each kitchen fireplace 2 feet wide, and full length of breast, firmly bedded in concrete.

Kitchen Lintels.—Provide a rubbed bluestone lintel, 8x10 inches, over each kitchen fireplace.

Girder Plates.—Provide necessary bluestone plates, as required by law, to receive the iron girders, also bond stones where marked B on plans.

Sidewalks, etc.—The sidewalks in front of these houses on street, 10 ft. wide by 30 ft. long, also those on avenue, 14 ft. wide by 220 ft. long, to be laid with composition pavement of approved patent on good bed of ashes or sand, to be Schillinger's, or equally good. The rear yards and areas to be laid with same pavement as above, pitched to outlets as directed.

Cellar Bottoms and Concrete in Floors.—The whole of the cellar bottoms to be concreted with broken stone and Rosendale cement in proper proportions to make a good hard floor 3 inches thick, the halls, kitchens, and closets to have sleepers bedded in concrete for wood floor; remainder to have a finishing coat of Portland cement 1 to 2 inches thick, and smoothly floated, to be graded to throw water to cesspool drain in cellar bottom.

Coal Chutes.—Make coal shutes as drawn of 12 inch glazed earthen pipe.

Tiling.—The vestibules to be tiled with tile worth 50 cts. per square foot, all laid on a foundation prepared by masons, each vestibule door to have the necessary marble saddle.

Terra Cotta Tiles.—Provide and set terra cotta tiles as shown on plans where marked T, those around second story windows of 1, 3, and 6 houses to be 10 inches square.

Ironwork.—Furnish all necessary iron anchors, clamps, holdfasts, etc., required about the buildings for carpenter, stone cutter, and mason; furnish all necessary bridle irons for framing as required by him, also the necessary anchors for beams.

Girders.—Furnish and set five cast iron lintels about 4 feet 6 inches long where directed, all to have 12 inch bed except that of No. 1 front (supporting third story of bay), which will have 24 inch bed, all to have 12 inch web of 1¼ inch iron, all the above to have strong skewbacks.

Registers.—Furnish and set two 10 by 12 inch registers in each house, one in kitchen and one in bath room, for ventilation, and to be worked by cord and wheel in usual manner.

Flitches.—Furnish two flitch plates in second, and two in third story beams of No. 2 house. Also one in No. 3, 4, 5, and 6 third story front rooms, and one in No. 6 third story rear. All to average 18 ft. long. Furnish requisite ⅝ bolts for above plates, 7 inches long.

Coal-hole Covers.—Furnish and set as shown on plans coal-hole covers 14 inches diameter.

Provide necessary fire rings and metal covers.

Provide iron guards for all front basement windows and cold air openings of neat pattern, also gates for front basement doors as drawn.

Also provide iron guards to all the rear windows in basement where opening into neighbor's yard.

To be of ⅝ in. iron, 3 inches from centers, with three ⅜ inch x 1⅜ inch bars, all to be well secured to brickwork.

Plastering.—The kitchens and w. c.s, also first, second, and third story ceilings, to have three coats of plaster, hard finished.

Remainder of the walls, ceilings, and furrings throughout are to have one good coat of browning, with sand and plaster skim finish, ready for papering; angles to be made true and straight, exposed angles to have quarter round.

Where studded and furred, to be lathed with good, sound, well-seasoned spruce lath. The brown coat to be well haired with fresh, long goat's hair. All to be of the best Thomastown lime and clean, sharp sand. The lime to be run through a box, and thoroughly slaked. Turn moulded arches where drawn. Cellar to be smoothly pointed and whitewashed. Cellar ceilings to have one coat, skimmed.

Cornices, etc.—Parlors, halls, d. r.s, and second stories to have neat plaster cornices and centers. Cornices averaging 8 x 6 inch centers, worth $1.00 each. To be say seven to each house.

Finally.—No extras will be allowed in this contract, save such as are authorized by printed slip furnished by architects.

The contractor is to give the usual and all necessary attendance to the above, and the carpenter, plumber, gas-fitter, bell-hanger, etc., and to patch up after they have finished.

To conform to all State laws and corporation ordinances in relation to building, and to be responsible for and make good any and all damages that may be done to any person or persons. To put in and pay for such pipe cock and box as may be required for water used in the erection of buildings. To pay for such water, and to give receipt to owners.

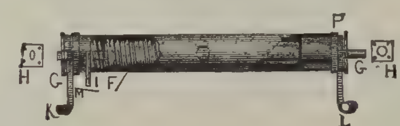
Clean up yards and street in thorough manner. Contractor is also to employ and pay proportion for a watchman for requisite time to care for the buildings until completed.

To furnish materials for setting furnaces, ranges, mantels, and grates, and to leave the place complete, broom-clean and perfect, at close of works.

Manufacturing Items.

The Ferracute Machine Company, of Bridgeton, N. J., are putting in a new 60 H. P. steel boiler, which will give them the power needed for considerably enlarging their factory, which they intend to do soon. Among the new tools to be put in will be a special boring mill and several other special machines. The new Ferracute punching presses are meeting with considerable favor, on account of their superior design and their great weight and strength, at very moderate prices. Among the orders which they have lately received is one from Germany.

THE ORMSBY SASH BALANCE.



The above cut represents our balance. The spring, F, which balances the sash, is coiled on the arbor, G; one end is attached to it, and the other to a pulley. At each end of the arbor there is a pulley; these are connected together by means of a cylinder, O.

M M represent the metallic bands or ribbons which connect the balance with the sash.

I represents the detention pin, used only to hold the spring from unwinding when it is desirable to remove the sash.

L K are the spools around which the bands are wound, and then inserted into the sash. These bands may be attached to the sash by screws only, if desired.

H H are the brackets in which the arbor rests.

IN NEW FRAME.

IN OLD FRAME.

When ordering, please state width of sash and weight of same as near as possible; also the height of opening and thickness of the sash.

The Ormsby Patent Sash Balance is not only applicable to house windows, but may be used for large doors, dumb waiters, or anything working in a vertical groove.

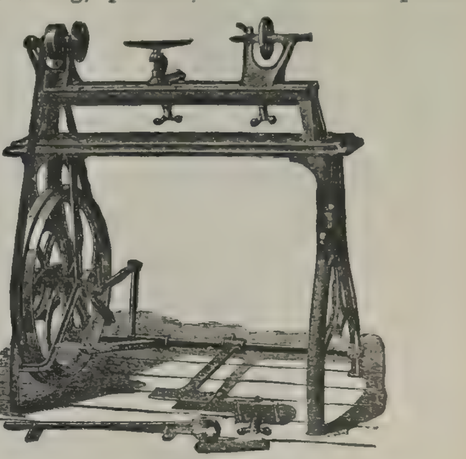
All communications should be addressed to the Ormsby Sash Holder Co., 92 Utica Street, Boston, Mass.

Lower Prices for Mahogany.

Owing to the large arrivals of mahogany during the past two months, prices have declined in New York about 15 per cent. Mr. J. Rayner has recently received at his yards, foot of Houston Street, East River, two cargoes of Mexican mahogany, of sound and excellent quality, aggregating about 350,000 feet, and averaging about 18 inches in width. He also has Spanish cedar and cabinet woods of every variety, which he cuts to any desired thickness for interior finish, together with a full line of fancy bracket woods for scroll-saw work. His advertisement will be found in another part of this paper; and builders who desire to obtain such stock from first hands will find at his yards an extensive line of goods from which to make their selections.

THE UNION LATHE.

The lathe herewith illustrated has many new and valuable features, and is designed for practical use in the workshop—turning in wood or metal, boring, drilling, and polishing, etc. It is strong and durable, being made entirely of iron and steel, except the stand top, which is hard wood. It has double treadles, working independently, and each being connected at opposite ends of the driving wheel shaft in such a manner as to produce a strong, positive, and continuous power.



THE UNION LATHE.

There are two changes of speed for a one inch flat belt. The head stock has a hollow steel spindle with brass boxes made adjustable to take up the wear. The lathe is provided with a compound slide rest attachment, that will turn straight or tapering, and face or square up surfaces to the full capacity of the lathe. A circular saw attachment can be easily and firmly attached to the lathe, in the same manner as the rests, and is designed for ripping, cross cutting, mitering, etc.

Full particulars concerning this admirable tool can be had by addressing the manufacturers, the Seneca Falls Mfg. Co., of Seneca Falls, N. Y.

Durability of Slate.

Writing on the durability of slate when exposed, Mr. A. C. Kimber says: "In the Granary Burying Ground, in Boston, there is a stone of slate erected to the memory of Captain William Condy, who died August the 25th, 1685. The style of lettering, position, etc., all indicate that it was put there soon after the burial. Yet every letter is clear and sharp, even the guiding lines scratched with the chisel being perfectly distinct. In fact, the stone seems to have suffered no change whatever. There are many others near it in the same condition, and of nearly equal age."

Protecting Iron.

The Bower-Barff process for protecting iron from rust, by covering it with a skin of magnetic oxide of iron, appears to be steadily gaining in favor in Germany. It is not infrequently mentioned in German technical journals, and always with approval. Recently at a meeting of a branch of the German Engineers' Society, at Hanover, a paper was read by one of the members, in which he very strongly recommended the process to engineers and architects. Speaking of the fine blue-gray color of the coating formed, he said that this was always the more beautiful the cleaner the surface of the articles operated upon. The coating adheres very strongly to the metal, but still not so strongly as to allow of working iron so coated beyond a very limited extent. Thus wire cannot be bent without cracking off the oxide formed on it. Therefore all articles to be protected should be finished before the oxidation takes place. As regards the strength of iron treated by the process, the results of experiments go to prove that wrought iron does not in any way suffer by the oxidation, and that cast iron gains in strength, inasmuch as the outer surface is to a considerable extent changed, and made like malleable cast iron, gaining in toughness.

There is a gain in weight of about one-half of one per cent, owing to the oxidation, and a scarcely perceptible increase of volume. The protection is very perfect, as has been proved by burying test pieces for one year in the ground in very damp and unfavorable places. The coating is liable to have its appearance injured by handling, and for objects where this is a matter of importance, it is better to brush the surface over with grease or wax, which is absorbed into the oxide and remains in it, permanently protecting it. Another property of objects coated with the oxide is specially pointed out as of great value for some purposes, especially for objects of art. The oxide coat easily takes enameling, silvering, gilding, or platinizing. The enamel, or the solution, can be put on direct upon the oxide, and then after firing adheres perfectly and has not the tendency to crack off, as in the case of its application to the bare iron. Then a coating of bronze or other metal can be given to objects in the simplest manner by brushing them over with a brush made of the metal in question. So much of the metal penetrates the oxide coating that the result is perfectly permanent.

THE HOUSES OF PARLIAMENT.

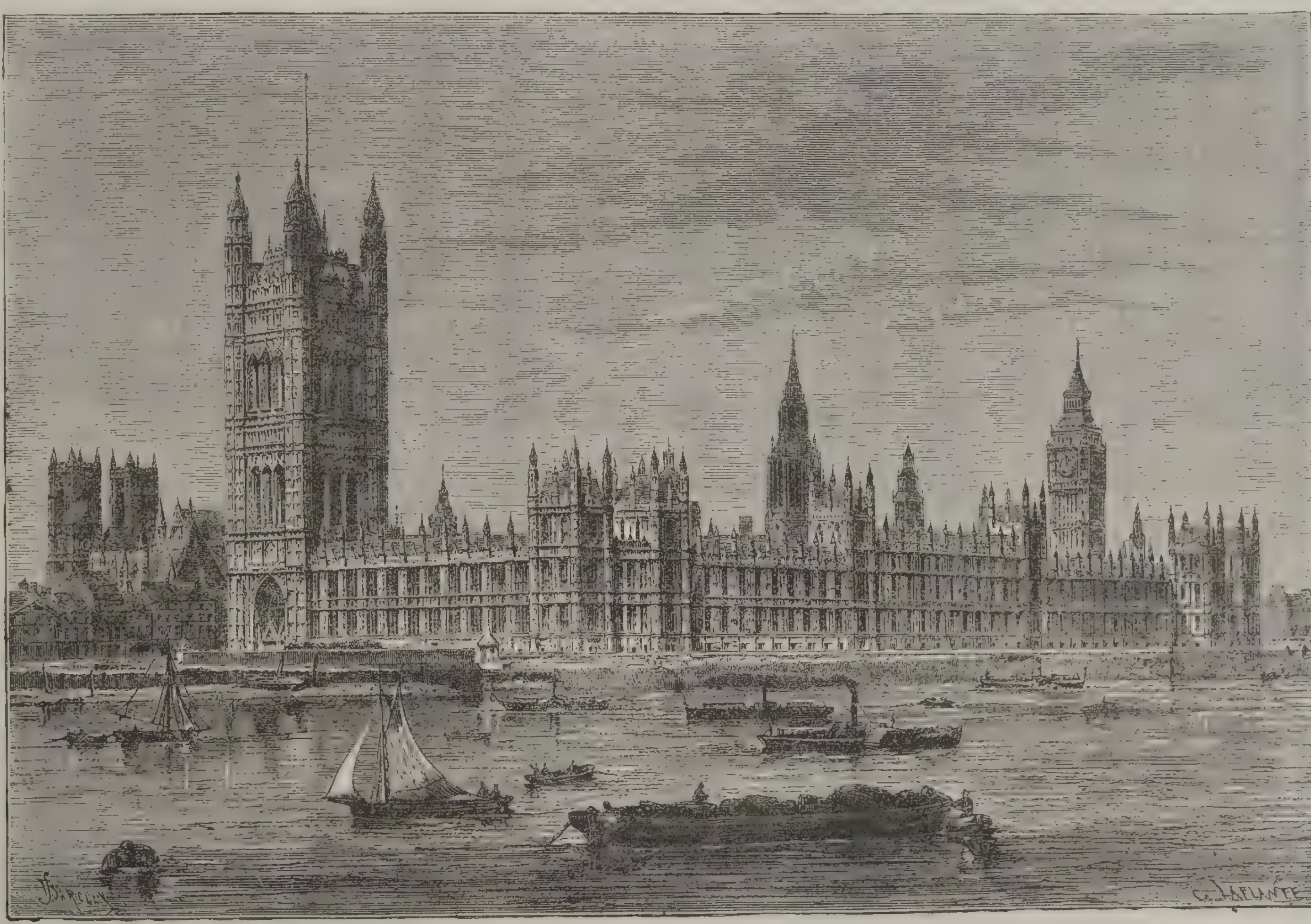
The Houses of Parliament, or the new Palace of Westminster, are among the most famous buildings of London, or indeed of the world. They are located on the left bank of the Thames, between the river and Westminster Abbey, and immediately above the Westminster Bridge. They occupy the site of the old palace, which was destroyed by fire in 1835, and cover altogether an area of about eight acres. The buildings, erected at a cost of $3,000,000, are in the Tudor-Gothic style, and contain 1,100 apartments, 100 staircases, and two miles of corridors. Our illustration shows the very ornate and effective facade, which is toward the river. The clock tower, 320 feet high, is at the northeast corner of the building, and strongly resembles the clock tower at Bruges, so well known through Longfellow's poem. The belfry is 40 feet square, and has dials on its four sides 30 feet in diameter, while those of St. Paul's are but 18 feet. The great Stephen bell, cast in 1858, weighs over eight tons, but is, unfortunately, defective in tone.

The central spire rises above the main dome to a height of 300 feet. At the southwest corner the Victoria Tower, 340 feet high, surmounts the royal entrance.

The House of Peers is located in the western portion of the building, and is 100 feet long and 45 feet in width and height. It is one of the most gorgeous legislative halls in the world, and contains the throne, a chair for the Prince of Wales, and the woolsack for the Lord Chancellor. The stained glass windows are lighted at night from outside.

The Queen's robing room, decorated with frescoes from the legend of King Arthur, faces the river, and is separated from the Victoria Tower by the Victoria Gallery and the Prince's Chamber. Since the gunpowder plot of 1605 a thorough examination of the cellars is made whenever the royal presence is expected. In the center of the building, St. Stephen's Hall is built above the ancient crypt of St. Stephen, the only relic of the old palace, which has now been restored and is used as a chapel. The hall is of noble proportions, containing twelve statues of illustrious statesmen, and separates the House of Peers from the Commons. This is located in the eastern portion of the building, and is much less ornate than the upper house. It occupies the site of old St. Stephen' Hall, and is 60 feet long, with a height and width of 45 feet. The Strangers' and Speaker's galleries (the latter for distinguished visitors) face the Speaker's chair, and are in front of the reporters' gallery.

The foundation stone of this vast pile was laid April 27, 1840. The chief architect was Mr. Barry. In spite, however, of the great expense and the many years consumed in their erection, the constructive features of the British Houses of Parliament are even more unsatisfactory than those of our own Capitol. While we have washed our marble columns with oxalic acid, in the vain hope of making them white, and have even been under the necessity of painting them, the English are forced to note, with considerable uneasiness, the decay of the outside stonework and the rapid deterioration of the interior frescoes of their legislative halls, and must give untiring attention for their preservation.



THE BRITISH HOUSES OF PARLIAMENT, LOOKING NORTHWEST.

AN American medical missionary, Dr. Allen, who settled some time ago in Seoul, the capital of the Corea, has commended his cause to the authorities so much by his skillful treatment of numerous officials who were wounded in the recent insurrection, he himself remaining at his post when all other foreigners had removed out of danger, that the government is now going to establish a hospital for him.

Loss of Weight in Coal by Storage.

In the course of a paper read at the late meeting of the Ohio Gaslight Association, the President (General Hickenlooper) gave the results of some experiments made by him to ascertain the loss in weight suffered by coal by storage. A certain number of pounds of coal were put into a box open at the top, with lattice work sides, and placed on a loft over a stack of benches; an equal weight of coal was placed in an open shed in the yard; while a third portion of coal was filled into a box similar to the one above described, and placed in a convenient situation on the top of the tank wall of one of the gasholders. After a year had elapsed the coal was reweighed. That near the stack had lost 11 per cent; that in the shed had decreased 10 per cent; and the third portion (that on the tank wall), greatly to the surprise of the gentleman who had charge of the experiment, showed a loss of only 1·74 per cent. General Hickenlooper thought the last result might, in great part be attributed to the fact that, just before the reweighing, there had been a heavy rainstorm, although there was no extraneous appearance of moisture about the coal. A fourth portion of coal, taken from a coal "wall" on the river bank, where it had been exposed to the action of the elements for about three years, showed a loss of 13 per cent. It appeared rather strange that, of the three first-mentioned lots, the one on the tank wall—the most exposed situation—should develop the least percentage of loss; yet such was the fact. Of course, there must have been somewhat contradictory conditions at work, since the specimen from the river bank had lost 13 per cent. The three portions were of identical quality, taken from the same mine.

Observation on Tree Growth.

An interesting observation on tree rings is recorded by Professor Bachelant. During a visit to the ruins of Palenque, Mexico, in 1859, M. Charnay caused all the trees that hid the facade of one of the pyramids of the palace to be cut down. On a second visit in 1880, he cut the trees that had grown since 1859, and he remarked that all of them had a number of circles greatly more numerous than their age would warrant, supposing one circle only to be added annually. The oldest could only have been twenty-two years of age, but on a section of one of them he counted 250 circles. The tree was about two feet in diameter. A shrub not more than eighteen months old had eighteen concentric circles. M. Charnay found the case repeated in every species and in trees of all sizes. He concluded that in hot and moist climates, where Nature is never at rest, trees may produce, not one circle in a year, but one in a month. The age of a monument has often been calculated from that of trees that have grown on their ruins. For Palenque 1700 years had been calculated, 1,700 rings having been counted on a tree. These observations, however, require the number to be cut down to 150 or 200 years. Prof. Bachelant asks if M. Charnay took account of certain colored rings which some tropical trees present in cross section, and which are to be distinguished from the annual circles.—*The Garden.*

Electrical Lamps for Fire Arms.

At the meeting of the Paris Academy of Sciences, July 6, G. Trouve described two new applications of electricity, which relate to the firing of arms at night. The first consists of a luminous electric button; and the second, of a powerful electric projector. These two devices are removable, and they can be applied instantaneously to any ordinary arms; to guns used for hunting as well as to weapons of war; to mitrailleuses, as well as to cannon, in fact, to any fire arms. Their function is automatic.

The electric button is the size of an ordinary metallic button, and consists of a fine platinum thread introduced into a little glass tube, which is, in turn, protected by a metallic tube. An opening is left in the metallic tube, by which to take aim, but said opening is so arranged that the luminous button is visible to the person using the gun only, and cannot be seen by the enemy. The button is operated by Mr. Trouve's reversible, hermetic pile, presented to the Academy of Sciences, by Mr. Becquerel. This pile, which is about as large as the little finger, can be secured to the barrel of the gun, parallel with the same, by means of two rubber bands. The hermetic pile operates only when placed on its side, that is, horizontally; therefore, it will be seen that when the person using the gun places his weapon in position for firing, the pile immediately begins to operate and illuminates the button; and that when the gun is held upright the pile ceases to operate, and the button is no longer luminous. The light given by the button is sufficient for taking aim, but cannot be seen by a person standing three feet from the gun. This is, of course, a great advantage, it being very difficult to take aim correctly in the dark.

The luminous electric projector consists of an incandescent lamp and a little parabolic reflector, or of an incandescent lamp and a concentrating lens enclosed in a metallic tube. The apparatus is to be applied to the end of the barrel of the gun, parallel to the same, by means of two elastic bands. It is put into operation by pressing the butt of the gun against the shoulder, and, by its use, the point to be struck can be lighted, and, if it moves, all its movements can be followed. The generator of electricity to be used for this apparatus is the same as that used for the safety lamp invented by Mr. Trouve, and recently presented to the Academy of Sciences by Mr. Jamin. It can be worn in the belt, and its action is automatic.

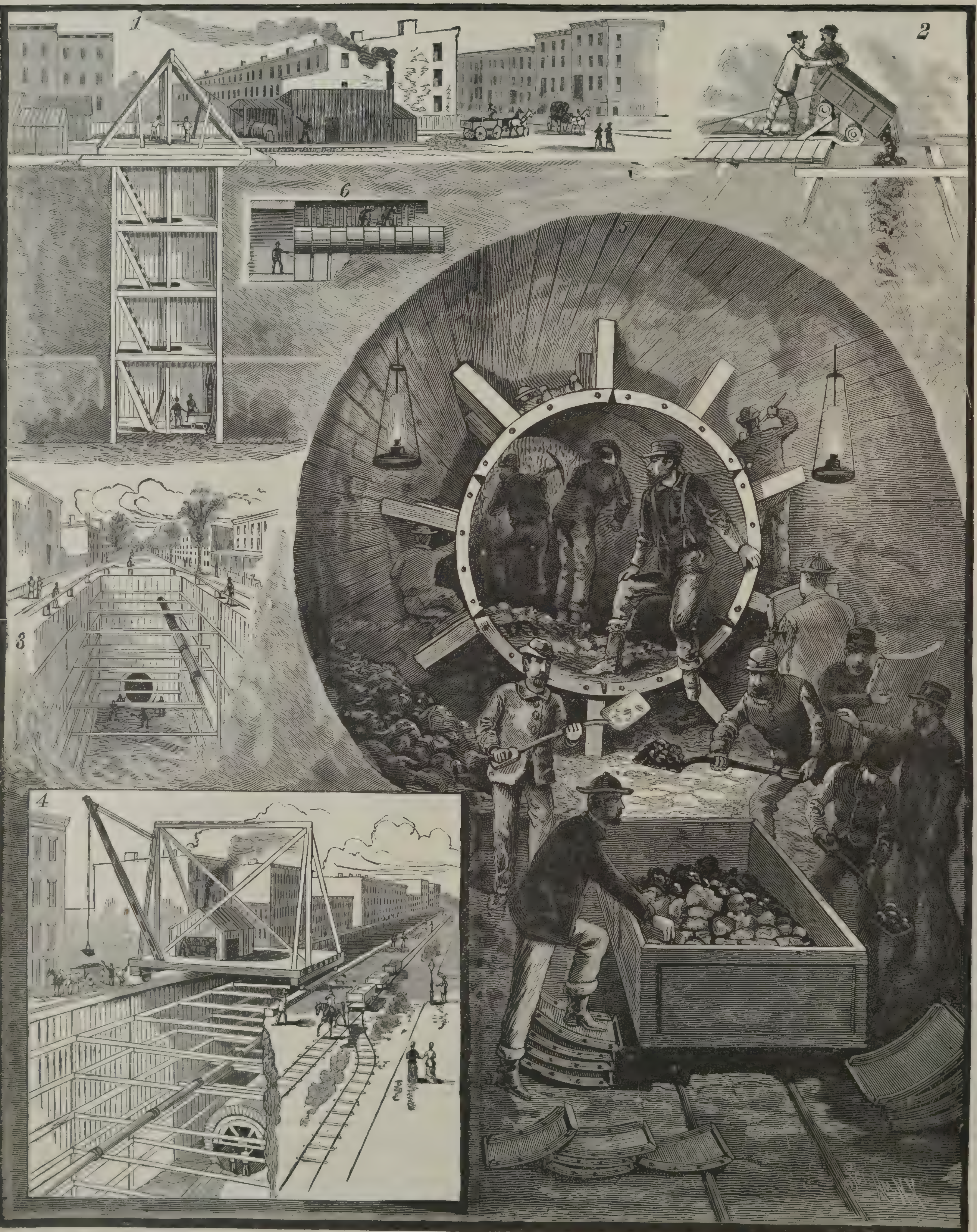
The services which these two apparatus are capable of rendering to armies and navies are numerous, but the great advantage which they offer is that they make it possible to aim as correctly at night as in the daytime.

Artificial Oil of Lemon.

By treating the rectified spirit of turpentine in the following manner curious chemical changes take place: Spirit of turpentine, 2 quarts; rectified alcohol, 3 pints; nitric acid, 1 pint. Agitate the mixture in a glass or earthen vessel and allow it rest. After one month the reaction will be complete, and a large quantity of hydrate of spirit of turpentine is obtained. This hydrate, mixed with alcohol, produces voluminous crystals. Submitted to the action of hydrochloric acid gas, the hydrate of turpentine loses a part of its water of crystallization, and is transformed into a hydrochlorate, having all the properties of the *camphor of lemon.* When heated it loses part of its acid; then treated by potassium, it is transformed into a fluid colorless oil, possessing the odor and chemical properties of the natural oil of lemon.

Corean Architecture.

A paper was read last year before the Society of Arts in Boston, by Mr. Percival Lowell, on the architecture of the almost unexplored country of Corea. The inhabitants of Corea, as is well known, although more than half Chinese, retain a certain individuality of their own, which they guard rigidly against any innovation. Among their peculiarities, the construction of their houses is one of the most remarkable. Like the Japanese, the Coreans build light structures of wood, filled in with screens of paper, but the latter know nothing of the endless ornamentation which makes the paper-covered houses of the Japanese so interesting; and the Japanese custom of setting dwelling houses directly on the street is offensive to the Coreans, who seek to give dignity to their habitations by making the approaches to them particularly imposing. For this purpose an outer "arrow gate" guards the entrance to all dwellings of importance, and inner gates and arches, opening sometimes into successive courtyards, serve, by repeatedly obstructing the visitor's way, to bring him into a suitable frame of mind for appreciating the exalted character of the personage whom he has come to see. The arrow gate, although a simple affair, is made to present a great deal of impressive symbolism to the superstitious natives. Two tall posts are set, one on each side of the passage, with their tops slightly inclined toward each other. Across these are placed two horizontal sticks, a little distance apart, lashed to the uprights. Resting on the lower cross pieces is a row of spear shaped pieces of wood, set with the points upward, and secured to the upper transom, above which they project a short distance. These are the "arrows," which a very ancient tradition connects in some way with the worship of the divine ancestors of the king; and the whole is painted of a bright red color. Besides the arrows, the gate bears a design consisting of two spirals, coiled in a circle, which, according to Mr. Lowell, "signify the positive and negative essences of Chinese philosophy," and above them is a representation of flames.



A GREAT SEWER BUILT BY AN IMPROVED METHOD OF TUNNELING, IN BROOKLYN, N. Y.

HOUSES · CORNER

SUPPLEMENT TO THE SCIENTIFIC AMERICAN-ARCHITECTS AND BUILDERS EDITION-JANUARY 1886

HOUSES · CORNER · 74th St · and · WEST · END · Ave.
New · York

Lamb · & · Rich · Architects
265 · 267 · Broadway.

SUPPLEMENT TO THE SCIENTIFIC AMERICAN-ARCHITECTS AND BUILDERS EDITION-JANUARY 1886

Schumacher & Ettlinger, New York.

THE KNICKERBOCKER AVENUE EXTENSION SEWER, BROOKLYN, N. Y.

The city of Brooklyn is now building a sewer, having an area equal to that of a circle 12 feet in diameter, from the junction of Knickerbocker and Johnson Avenues, through Johnson Avenue and South 5th Street, to the East River. The necessity for the work is apparent from the fact that the present outlet sewer for this section of the city, which drains an area of about 2,800 acres, some of which is very low and flooded by every rain, is discharged upon the low lands at the head of Newtown Creek, making a nuisance greatly detrimental to public health and damaging to valuable property in the vicinity. Frequent complaints from people living near this outlet and by the Department of Health rendered the construction of a new outlet absolutely necessary.

Although there is nothing new either in the sewer itself or the duty it is designed to perform, the method of building one section of about three-quarters of a mile in length is certainly unique and interesting. Owing to the depth of the grade lines of the sewer below the street surface, in the greater portion of section one (next the river), and the danger to heavy buildings on both sides of South 5th Street, it was thought better to prosecute the work by means of tunneling rather than by open trench. Our frontispiece is composed of views showing the manner of prosecuting the work, both in the tunnel and in the open cuts.

The section of the sewer for almost its entire length is circular, 12 feet in diameter inside; and where it has been essential to alter this form, the sectional area has been made the same. The sewer is built of brick laid in cement, and the minimum thickness is 12 inches. At some points a foundation was made of transverse and longitudinal timbers, and the brick invert was reduced in thickness to 8 inches, between which and the timber was a bed of concrete. Where necessary, retaining walls, 3 feet thick at the bottom, 2 feet thick at the top, and extending a short distance above the center line of the sewer, were built. For the greater part of the tunnel section, the work passes through sand, and the sewer is a simple ring of brick. At each crossing street is a manhole, 3 feet in diameter, where it joins the arch, 2 feet in diameter at the surface, and in height varying with the depth of the sewer below the street. The outer end of the outfall is 18 feet in width and 6½ feet in height, measured from the center of the invert, the curve of which has a radius of 41 feet; the sides are vertical, and on them rest iron I-beams, 12 inches deep, and varying in length from 20 feet at the outer end to 13 feet where the outfall sewer joins the circular one.

The general method of prosecuting the tunnel portion of the sewer has been to sink shafts at about every 700 or 800 feet, and then drive the headings each way. Fig. 1 represents the shaft on South 5th Street near 5th, which is 64 feet in depth to the bottom of the invert. The sides are held by sheet piling, and extending through the center are guides for the cage, the machinery for operating which is in the building shown at the right. A track is laid down each tunnel to the heading, as shown in Fig. 5. The cars filled with the excavated material are run to the bottom of the shaft, raised to the surface, and run to the dumping ground. Just east of 5th Street it was necessary to build a short section (Fig. 3) by open cut, and after this had been completed, the earth for filling in was obtained through the shaft shown. Fig. 2 shows the dumping car here used. The faces of the forward wheels are narrower than those of the rear ones, thereby permitting them to pass between the ends of the rails, which are inclined upward at a sharp angle, and rest in the curved parts of inner rails. The rear wheels mount the inclined rails, thus tilting the car and dumping the load.

Fig. 5 is a view looking into the heading, and Fig. 6 is a longitudinal sectional elevation of the same. The pilot tunnel here used is the invention of Mr. J. F. Anderson, and was first used upon the Hudson River tunnel; the duty it performs in its present location is precisely similar to that it performed under the river. The pilot is 5½ feet in diameter, and is made up of interchangeable flanged iron plates, bolted together. It is kept as near as possible in the center of the tunnel, and is extended some distance ahead of the finished masonry, the advance being made by removing the rear plates, carrying them forward, and bolting them to those already in place. The forward end of the pilot being in undisturbed ground, and the rear end being firmly held by radiating struts resting against the masonry, there is formed a rigid center or hub from which the work can be braced.

In the heading, the earth at the crown is removed and an iron plate inserted; this plate is bolted to the one already in, and is held by a strut against the pilot. These plates, unless the earth is very treacherous, are only carried about half way down each side. After the plates have been put in far enough, the section next the masonry is cleared, and a portion of the brickwork built.

This method of tunneling not only gives an exact idea of the nature of the material in advance of the main work, but also serves to firmly hold the sides of the excavation, preventing caving in; and where the route extends through a street lined upon each side with houses, and, as in this case, at an unusual depth below the surface, it has many advantages over the ordinary open cut. In addition, it occupies the street only at the shafts, so that travel is not much interfered with.

Fig. 4 shows an open cut portion of the work. Before beginning operations, the old sewer was removed and a new one built under each sidewalk, as a temporary measure during construction. A platform carrying the hoisting machinery extends across the trench, and is mounted upon wheels running upon tracks laid at the edge of the opening. The sides are held in the usual way by sheet piling braced by timbers extending across the opening, and which also carry the gas and water mains.

It is estimated that the total cost of the sewer—which will be finished in a short time—will be $575,000.

IMPROVED CORK ATTACHMENT.

The art of bottling liquids has attained quite large proportions as a distinct business. The machinery and appliances for driving and fastening the corks have been well studied, and brought to a considerable degree of perfection. But the reverse process, that of unbottling, has received less attention. It is usually left to the individual to struggle with the wires and a corkscrew as best he can. If the cork be of good quality, and not too tightly wedged, he succeeds fairly well; but it often happens that this is not the case, and numerous fragments of cork, perhaps the largest portion on the inside of the bottle, is pretty sure to be the result. We illustrate the cork attachments devised by Mr. John W. Hayward, of St. Johns, Newfoundland, which makes it as easy to get a cork out of a bottle as it is to drive it in. An ordinary cork, O, of the required size, has a piece of strong non-corrosive twine, 1, let into its sides. A button or shield, 5, also non-corrosive, is placed on the inner end of the cork to prevent the twine cutting through it. A hand metal tag, 2, is secured on the twine where it is knotted, or in case a capsule is placed on the end of a piece, 4, which hangs below the capsule.

HAYWARD'S IMPROVED CORK ATTACHMENT.

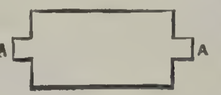
A rubber button, 3, placed on the outer end of the cork, has a hole or slit through which the twine passes. In 6 is shown the wire attached to the bottle neck, 6^1 representing the hook, and 6^2 the manner of locking it in place. 7 gives the appearance of a bottle when corked and the twine secured on the wire hooks. In 8, a capsule has been placed over the cork, and the tag is seen protruding beneath its edge. 9 shows the manner of securing the twine over the wire by stretching the elastic button, 3, and 9^1 the top view of the bottle when the operation is completed.

When the cork is being driven into the bottle, the rubber button is turned over on the twine and tag, as shown in 10, to protect them from injury. The button is then reversed, one loop of the twine passed under the wire hook on one side, and by stretching the rubber button the other loop secured on the opposite hook. The process of unbottling is shown in our last figure. The tag is grasped, and by an upward twist the capsule is torn open. The twine is disengaged from the wires, and, by passing the first and second fingers through the loop, the cork can be readily drawn. This system does away with the corkscrew entirely, each cork carrying its own means of release. It is applicable for any liquids, medicines, liquors, inks, etc., and as the corks are not injured they may be used a number of times. Mr. A. B Cohu, 197 Water Street, New York city, has the agency for this attachment.

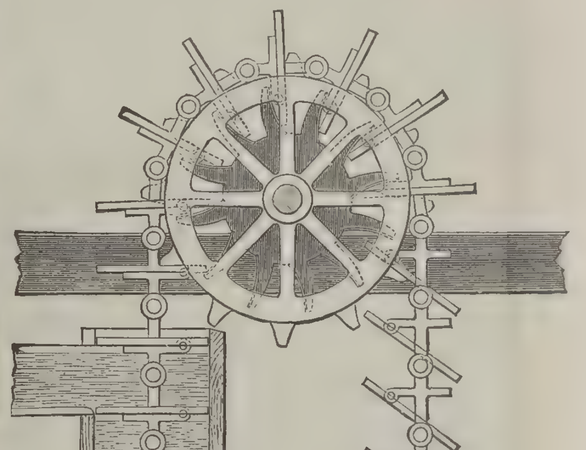
BALANCED WATER MOTOR.

At the Inventions Exhibition, London, Sealey Allin, Queen Victoria Street, shows a patent balanced float water motor, with which he claims to obtain a working efficiency of over 90 per cent. Our illustration is from the *Engineer*. It consists of a series of feathering floats, hinged to a chain which works over a pair of drums, the floats on the descending side being inclosed in a casing, so as to form a series of moving chambers, which are successively filled with water as they enter the casing.

A cross section of the casing is shown in the annexed sketch. A A are planed grooves, in which slide projecting pieces forced on each link of the chain, the clearance being limited to one-sixty-fourth of an inch. The clearance of the floats themselves can, therefore, be made very small, and the inventor states that in this way he has been able to reduce the loss from leakage to a comparatively insignificant amount.



The feathering of the floats is automatic, and is regulated by the level of the tail water; for so long as the pressure of water behind is greater than the resistance in front, the chain is pushed forward. As soon, however, as the resistance exceeds the pressure, the floats fall away from the chain, and rise nearly vertically out of the water. The power is taken off from the top drum, which is provided with specially formed teeth, which take each link of the chain as it passes over. The speed of the chain is about 180 feet per minute. Assuming that the difficulties of construction have been overcome, there seems no reason to doubt that the efficiency of such a motor as this will be much greater than that of even the best waterwheels, as a greater percentage of the fall can be utilized.



ALLIN'S WATER MOTOR.

It must not, however, be forgotten that hitherto, in the majority of cases where waterwheels have been applied, economy of water has been a secondary consideration, and there is, after all, something very fascinating in the simplicity of a waterwheel. What it may be in the future is, of course, a different matter. Probably, if any serious attempt is made to take advantage of the power to be derived from natural falls of water, or, as Mr. Allin proposes, of the rise and fall of the tide, more attention will be paid to efficiency; and if, as is stated, about 93 per cent of the actual energy can be given off in useful work, there may be a considerable field for Mr. Allin's invention.

A "WORKINGMAN'S" COLLEGE, MELBOURNE.

The accompanying illustration represents one of many endowed institutions with which the young city of Melbourne, Australia, is liberally supplied. The city had grown from a population of 25,000 in 1851 to 300,000 in 1881, and with this rapid growth many great fortunes were made, principally in gold mining, wool growing, and land speculations, and many of those thus suddenly acquiring wealth have expended it with a free hand in beautifying their principal city and the founding of educational institutions. The "Workingman's" College herewith shown is free to all, instruction being given therein to all applicants, both day and evening, in practical mechanical work of a wide variety, mechanical drawing, mathematics, and all those branches which will aid an industrious and determined workman to rise in his calling. It is one of those practical institutions everywhere needed, but likely to be especially useful in a new and rapidly growing country, where the adventurous and enterprising from all quarters of the world are attracted in unusual numbers.

Melbourne is built on numerous gentle hills, which show off to advantage its many fine public buildings. The streets are all 99 feet wide, and the parks, squares, and gardens are so numerous that with only one-thirteenth the population of the city of London it occupies nearly half as great an area. The Melbourne University is a picturesque mass of buildings, behind which is the National Museum, freely open to the people, as are all public places in Melbourne. There are in Melbourne, among its numerous state schools, about thirty whose size and proportion entitle them to rank with the architectural ornaments of the city. It is said there is no city where more has been done for the working classes, or where they have made so good a use of their adventages, about three out of every four mechanics who have reached middle life owning the cottages they occupy.

WORKINGMAN'S COLLEGE, LATROBE STREET, MELBOURNE, AUSTRALIA.

Steel Rails in the United States.

The productive capacity of the steel rail mills of the United States is about 1,600,000 tons per annum. About 600,000 tons went into new lines last year, and the amount used as renewals, new second track, and siding is estimated at 650,000 tons, or 5·42 per cent of the total amount of rails in track. This rate is equivalent to a renewal of the lines once in 18·4 years. At the end of 1883, a little more than half the track of the United States was iron. The consumption of rails for maintenance ran down from 10·30 per cent in 1872, when steel rails were first used, to 5·92 per cent in 1877; then rose again to 11·16 per cent in 1881, and receded again to 5·42 per cent in 1883. The production of steel rails increased from 83,391 tons in 1872 to 1,304,393 tons in 1882.

The Bellevernon Gas Well.

The Bellevernon (Pa.) gas well is now nearly 2,800 feet deep, and drilling ceased. At about 200 feet, a 3 foot vein of coal was struck, and was the only coal found. At 400 feet a pretty strong vein of salt water; and at 600 feet another vein of salt water. At 1,950 a vein of gas was found in what appeared to be a compact rock formation. The gas not being as large in volume as desired, the drill was sunk to the present depth of nearly 2,800 feet, and no more gas being found the well was torpedoed at the gas vein, first with 40 quarts of nitro-glycerine, and then with a hundred quart torpedo, enough to turn the well inside out. This increased the flow of gas, and it is thought there is sufficient now to heat a 10 pot furnace.

New Alcoholic Ferment.

At Busalla, in the north of Italy, there is a small brewery which has gained a considerable reputation for its beers brewed on the low fermentation system. Last season these beers were very inferior, and without any apparent reason. A local chemist, M. Mendes, was called in to investigate the matter, and the result of his researches was the discovery of what is believed to be a new form of ferment. Among the cells of ordinary Saccharomyces cerevisiæ were some of Saccharomyces Pastorianus, and some other cells very much smaller in size; these latter were isolated and cultivated by themselves, and were then found to be almost spherical in shape, and from 1-300 to 1-500 of a millimeter in diameter. The shape, size, and general appearance of the cells of this ferment were found to be very constant, and they very closely resembled those represented on the right hand of the plate iii. in Pasteur's "Etudes de la Biere." So far there would be nothing very remarkable in the identification of a new form of ferment, but M. Mendes by some carefully conducted experiments has proved that this ferment is altogether without action on cane sugar. It is generally admitted that ordinary yeast is not capable of directly fermenting cane sugar, but that it first exerts an inversive action on cane sugar, and after this inversion fermentation takes place. Now the peculiarity of the new ferment discovered by M. Mendes is not that it will not ferment cane sugar, but that it will not invert it. Experiments were made with this new ferment on impure cane sugar solutions, and the result was said to be that the glucose and invert sugar was fermented by it, but the cane sugar was left untouched. The practical importance of this discovery to sugar refiners must therefore be very great, and it is at the same time of very considerable interest to brewers. We propose to refer to it in greater detail on a future occasion.

A Wonderful Grotto.

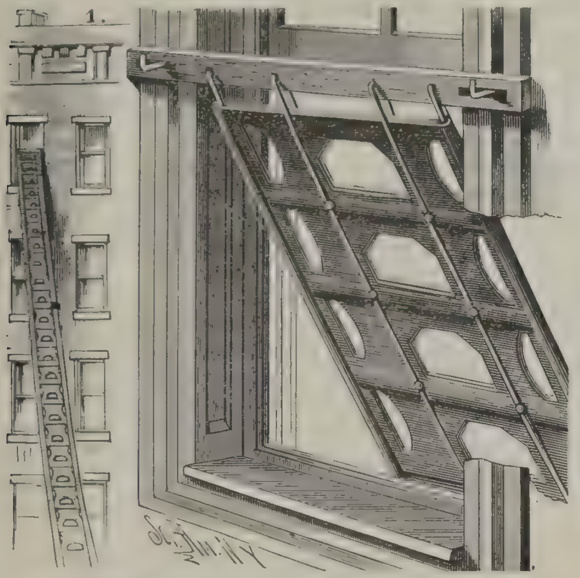
A correspondent in Cagliari writes to the *Avenire di Sardegna* the following description of the stalactite grotto discovered not long ago at Dorgali, in Sardinia, which is approached by a difficult and tortuous path leading down into a gloomy ravine on the mountainous coast: "The grotto commences by an ample space, the vault of which is supported on columns. On the rocky ground may be seen the print of a human foot. From this place you enter a vast hall of such magnificence that it extorts an exclamation of wonder. Sixteen columns with varicolored capitals rise from the marble floor and sustain a pure white roof, from which depend the figures of birds, guns, serpents, baskets of fruit, and a thousand other tricks of nature. But the most striking object is an altar ornamented with enormous baskets of colored flowers, and on which are large candelabra and a shrine so exactly imitated that you are tempted to try to open it in order to see the chalice within. From the roof above hang festoons of flowers, which reach down almost to the altar as if attempting to conceal it. The most wonderful thing in the hall was, however, the petrified skeleton of a majestic stag, which was partly destroyed by visitors, and the spine of which has been sent entire to a professor of natural history in Cagliari. The grotto contains six other large chambers, decorated with arabesques in stalactite, and full of pillars, human figures, opaque mirrors, and other wonderful imitations of objects of art and nature."

Cab and Hack Indicator.

Ackerman's *Gewerbe Zeitung* gives a description of a new apparatus for cabs, hacks, gurneys, etc., to register the amount of time each person hiring the vehicle retained it and paid for, thus preventing the possibility of fraud on the part of the driver. Most of these registering apparatus are too complicated and expensive for general use, but this objection does not apply to this new invention. It consists of a clock movement with index and dial beneath each seat in the cab. The movement is inclosed in a box to protect it from dust, and when the cushion is lifted up, a small cover over the dial is seen; this cover locks down, and only the owner of the cab line keeps the key. Lifting this cover, the register can be read at a glance. The cushion is so arranged that the weight of a person seated upon it presses a lever in the clock works and sets the train in motion, while the weight of any ordinary article of baggage is not sufficient to accomplish this. The train keeps in motion as long as the seat is occupied, but stops short when the customer quits the vehicle. By this means the proprietor is able to inspect this automatic register of the number of hours and minutes the vehicle has been employed in transporting passengers.

A FLEXIBLE LADDER FIRE ESCAPE.

Two pieces of canvas, or a single folded piece, are stitched transversely to form pockets to receive cross bars. The canvas is then stitched along its side edges to form passages for the side ropes. Near the sides are formed hand openings, and just over the cross bars in the center are foot openings. Along both sides of the ladder are placed ropes, which are secured to the canvas by stitching, and to the bars by rivets or staples. When the ladder is to be used as a fire escape, one end is attached to a cross bar of wood or iron, having slots made in it to receive hooks secured to the casing of the win-



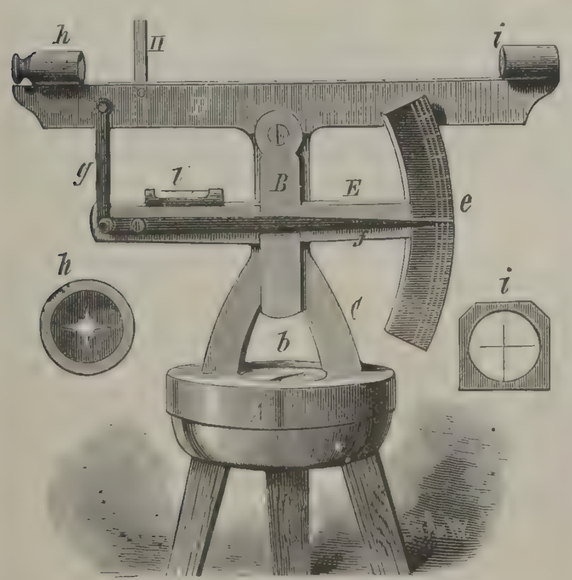
WRIGHT'S FLEXIBLE LADDER FIRE ESCAPE.

dow. For further security, hooks or grapnels may be secured to the ends of the ladder for anchoring the lower end to the ground, and for attaching the upper end to any convenient object within the room. The ladder is to be secured on the inside of the window at the top of the lower sash, so that persons can step upon it from the window sill and descend on the inner side to the ground. It is made in sections, in order that any desired length can be obtained. Constructed in this manner the ladder is cheap and strong, and, being flexible, can be rolled up so as to occupy but little space, while it can be quickly adjusted when needed as a fire escape.

This invention has been patented by Mr. Edward P. Wright, of Portland, Oregon.

LEVELING INSTRUMENT.

In a recess in the base, A, which is pivoted upon the top of the tripod, is fitted a compass for use in obtaining right angles. Attached to the base is the standard, C, pivoted to one side of which is the bar, D. Mortised into the bar is the hanger, B, held by the same pivot screw that secures the bar to the standard, so that both parts can swing independently. The bar, E, is attached to the hanger so as to form side arms, one of which carries a scale bar, *e*, while to the other end is pivoted a pointer, *f*, that is connected by a link, *g*, to the top bar. This bar carries front and rear sight tubes, *h i*, the latter of which is fitted with crossed wires, and the former with an eye piece consisting of a disk of metal with a central hole and radial notches. Where a centrally



MUNFORD'S LEVELING INSTRUMENT.

apertured disk was used without the notches, the central part of the aperture, with respect to the crossed wires, was more difficult to determine, as the horizontal and vertical central lines of the apertures had to be imagined, whereas, by this construction, they are plainly indicated by the notches. The bar, D, is also provided with a rod, H, for use in obtaining perpendiculars.

The instrument being planted, the hanger is turned to level the bar, E, which is determined by placing a pocket level on the bar, as shown at *l*. The end of the pointer, *f*, is then brought to the zero point on the scale and the bar, D, thus moved to the level. If a line is to be run with a rise or fall, the pointer will be correspondingly adjusted to the scale, which, being properly proportioned to the adjustable parts of the instrument, may also be used for measuring altitudes and distances.

This invention has been patented by Mr. Wm. H. Munford, of Anna, Ohio.

Scale Hardness of Metals.

The following is a scale of hardness in use in the laboratory of the Technical High School at Prague, composed of eighteen metallic substances, arranged in ascending order from the softest to the hardest:

1. Pure soft lead. 2. Pure tin. 3. Pure hard lead. 4. Pure annealed copper. 5. Cast fine copper. 6. Soft bearing metal (copper, 85, tin, 10; zinc, 5). 7. Cast iron (annealed). 8. Fibrous wrought iron. 9. Fine grained light gray cast iron. 10. Strengthened cast iron (melted with 10 per cent of wrought turnings. 11 Soft ingot iron, with 0·15 per cent carbon (will not harden). 12. Steel, with 0·45 per cent carbon (not hardened). 13. Steel, with 0·96 per cent carbon (not hardened). 14. Crucible cast steel, hardened and tempered, blue. 15. Crucible steel, hardened and tempered, violet to orange yellow. 16. Crucible steel, hardened and tempered, straw yellow. 17. Hard bearing metal (copper, 83; zinc, 17). 18. Crucible steel, glass hard.

The test is made by drawing a cylindrical piece with a conical point along a polished surface of the metal to be tested. In the case described, that of a bronze used for the cross head guide of a locomotive, the point, when loaded with five kilogrammes, was drawn six times through a distance of three centimeters. Under these conditions the points of the number below five in the scale were blunted without marking the surface; with Nos. 5 and 6 neither point nor surface was abraded; but No. 7, while being slightly worn on the point, began to scratch the surface. The hardness was, therefore, that of pure copper or soft bronze. The absolute tensile resistance was found to be 2,051·7 kilogrammes per square centimeter, while that of copper is 1,920 kilogrammes per square centimeter, and that of the bronze, No. 6, is 2,300 per square centimeter, thus showing an intimate relation between the strength and hardness of similar metallic compounds.

The Pneumatic Postal System of Paris.

The pneumatic system in Paris has recently been extended to the suburbs, and a very important service will shortly be opened by the postal authorities. This system has cost upward of a million francs for the laying of the pipes and the erection of the appliances. The longest distance between any two points in the system is 11,000 meters (about seven miles), and the uniform charge has been fixed at three pence for the delivery of a letter within one hour after its receipt. Compared with either the London postal or telegraph system, the facilities thus placed within the reach of Parisians are far greater.

GRAVITY FRICTION CLUTCH.

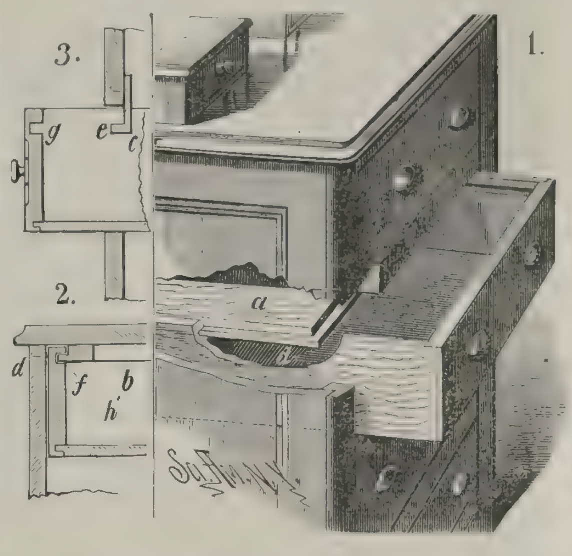
The object of the invention recently patented, herewith illustrated, is to provide a clutch for a mowing machine—or any other machine requiring a clutch—that will be noiseless and will take up all lost motion, in order that the knives may begin to operate the instant the wheels move, thus preventing the machine from clogging or leaving any grass standing. It is also designed for use upon horse rakes, sewing machines, etc.; when used upon the former, it causes both wheels to begin working at the same time, thereby obviating the jerking of the shafts against the horse, as in the case with a pawl-and-ratchet device. The disk, C, is recessed inside, and has a hub formed with a set screw, by means of which it may be rigidly secured to the shaft. The disk, B, is formed with a cam, B′, upon its inner face. Neatly but loosely fitting the recessed inside of the disk are the disk segments, E. When the disk, C, is revolved in the direction of the arrow, the eccentric hub, B′, binds against the segments, E, and the loose disk, B, is revolved in the same direction. When the disk, C, is moved in the opposite direction, the segments will not bind, but be carried around in the disk.

Figs. 3 and 4 show the same idea differently carried out. The circular plate is provided with a triangular-shaped hub formed of three eccentric arcs and three tangents, the latter meeting the arcs at the centers of the sides of the triangle. The recessed disk carries three disk segments, which bind against the triangular hub when revolved in one direction, and which are carried around when the direction of revolution is reversed. These clutches will not exceed in expense the ordinary pawl-and-ratchet, and are durable and effective in operation.

Additional particulars may be obtained by addressing the inventor, Mr. Anson D. Simpson, of Niverville, N. Y.

DUST COVER FOR DRAWERS.

The covers, *a*, *c*, are made to wholly or partly close the top of the drawers by tongues, *d*, *e*, on which corresponding groves, *f*, *g*, of the box sides and front ends will close when the drawers are shoved back into their cases, the covers being attached to the cases so as to remain stationary when the drawers are moved. The covers may close the whole of the drawers, as shown in Fig. 1, or only close with the front end, as in Fig. 3. The latter device may be easily attached to the front board of drawers in use, and is a simple angle strip having the tongue, *e*, suspended suitably for closing in the groove, *g*,



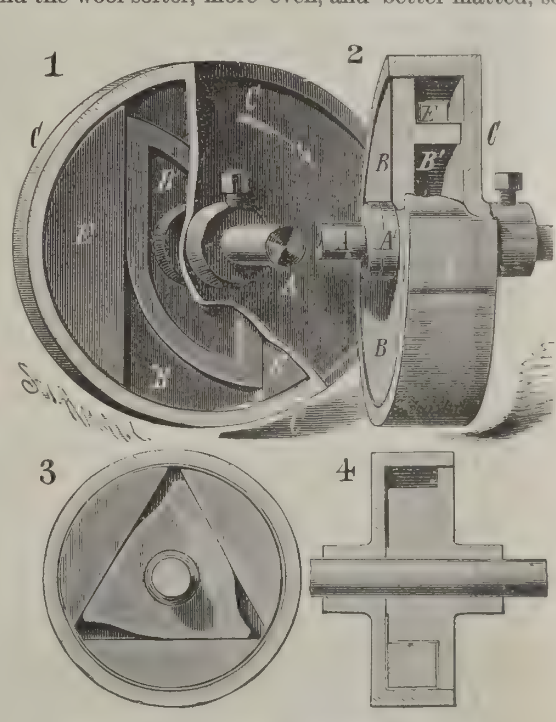
HAMILTON'S DUST COVERS FOR DRAWERS.

which may be readily made in the front end of the drawer. These covers may be solid boards of the whole width of the drawer, or they may consist of a frame, Fig. 2, which will, when attached to the case, serve the same purpose, and as well as if solid. Constructed in this manner the drawers of a bureau, desk, or counter may be tightly closed so as to exclude the dust.

This invention has been patented by Mr. Alfred J. Hamilton, of Beaverton, Oregon.

Good Wool.

The production of a first class fleece of wool cannot be accomplished by a novice. It requires, in the first place, a well bred sheep, and then care in feeding and handling through all the stages of growth, and very great care in handling the fleece after it leaves the sheep's back. No matter how well bred a sheep may be, nor how good a fleece it naturally has, unless it is properly treated, its wool will be unmerchantable. Many think it does not matter how the sheep is kept, the fleece will grow just the same, and be as nice as the fleece on a well fed and shedded animal. It would be well for these men if they would compare their clip of wool with those of some of their neighbors who treat their sheep the way they should, giving them plenty to eat, and shedding them from all storms. They will find the wool softer, more even, and better matted, so



SIMPSON'S GRAVITY FRICTION CLUTCH.

that it makes nicer looking fleeces.—*National Stockman.*

Depression in the Copper Industry.

The price of copper is now so ruinously low that the miners in some parts of the country are closing their works. Seven and a quarter cents a pound on the spot has been received. Lake Superior copper, the best in market, is worth in New York eleven and a half cents.

Imitation Marble.

A good imitation of marble can be made, it is said, by soaking plaster of Paris in a solution of alum, bake it in an oven, and then grind it to a powder. In using, mix it with water, and to produce the clouds and veins stir in any dry color you wish. It will become hard enough to be susceptible of a polish, and will be found especially useful in mending broken marble slabs.

Safety Against Fire in Buildings.

A meeting of the Insurance and Actuarial Society of Glasgow was held on April 8, when Mr. A. B. Dansken read a paper on "Notes on Buildings."

Having given a short summary of the various building acts in England and in America, Mr. Dansken said that the London and Liverpool acts were the models for all others in England. In Scotland they had no act really worthy of the name. In Boston and Montreal, on the other hand, the acts were of a more general nature than those in this country, though they contained some excellent provisions which might with advantage be adopted here. The Metropolitan acts contained excellent structural arrangements. Liverpool had paid great attention to regulations for the storing of goods within the boundaries of the borough, while Montreal had special regulations for the erection and use of steam boilers, furnaces, stoves, and such like. Great improvement had recently taken place in the storing of goods, particularly in London and Liverpool, and what was required in Scotland was a general building act similar in its provisions to those of London and Liverpool. The most fruitful sources of fires in dwelling house property were defective hearths and vents (flues), and this was borne out by the fire returns of various cities. The percentage in Glasgow was three times greater than in London, more than double that of Liverpool, and one-fourth more than Manchester. The reason of that, says the *Architect*, was not far to seek, for the Metropolitan Building Act required that hearths "shall be solid for a thickness of seven inches at the least beneath the upper surface of such hearth or slab;" while in Glasgow not only were there no regulations as to hearths, but the practice was to lay them on the bare wood—the most dangerous that could be adopted. Considering how gables and party walls were built in Glasgow, it was not surprising to learn that a great many fires occurred from defective chimneys. In the construction of dwelling house floors Mr. Dansken referred to the present method of deafening by filling in between the joists a layer of ashes or rubbish on loose boards, and suggested that if the space between the joists was filled in with concrete the floor would be practically fireproof. A floor of that kind immediately above shops would confine a fire, or at least retard its progress very considerably, and render the dwelling houses much safer. Were that system adopted in mansion houses, there would be fewer instances of their total destruction. Having given some hints as to how to deal with lightning rods, Mr. Dansken proceeded to refer to warehouse and shop property. As the danger from fire increased proportionally with the size of the building, he thought some legal restrictions should be placed on their limits, for the extra rates charged for large warehouses had had little or no influence in that direction. Within recent years it had become the practice to have ceilings and walls of warehouses wood lined. That very largely increased the risk of fire; but it might be remedied to some extent by having asbestos felt under the wood lining of the ceilings and the space behind the lining of the walls, and filled up at intervals with belting of cement or plaster. Dealing with fireproof iron doors, Mr. Dansken referred to several varieties, but said that he preferred one formed of a combination of corrugated iron and asbestos. With respect to the mode of hinging them, he thought that where practicable the hinges should be bolted through the full thickness of the wall, and that the steps of the doors should be raised higher than the floor level on either side, to prevent liquid flowing from one floor to another. Mr. Dansken concluded by referring to different forms of floors suitable for public buildings, in which a combination of iron and concrete was treated in various ways.

J. J. Keller.

Mr. J. J. Keller, senior member of the well known chemical house of John J. Keller & Co., of this city, died recently aged 61, the victim of a mistake in the giving of medicine. As a remedy for facial neuralgia his physician prescribed, or intended to prescribe, for him a dose equal to three-quarters of a milligramme of sulphate of atropine. By some error as yet unexplained, the dose given to the sick man was three-quarters of a gramme, or one thousand times more than had been intended. The patient took the dose, became immediately unconscious, and soon after died.

Atropine is an alkaloid obtained from the belladonna plant, or deadly nightshade. It is a very active poison, but a very excellent and wonderful medicine when rightly used. It is especially employed by oculists in treating diseases of the eye, having a remarkable effect in dilating the pupil.

The Kaolin Beds of Chester County, Pa., and of New Castle County, Del.

BY GRAHAM SPENCER.

For the last fifty years the manufacture of china in this country has been steadily growing, and is now an important industry, and one that is increasing in the quantity as well as quality of its goods yearly. The first pottery in America was established in Philadelphia, about half a century ago, by a man named Tucker, who carried on the business for some time, making very excellent semi-porcelain ware. Since then, Trenton, New Jersey, is the great point of manufacture east of, and East Liverpool, Ohio, west of the Alleghanies. Besides these, Baltimore, Wheeling Steubenville, Beaver Falls, and Cincinnati, and a number of other places have one or more potteries located in them.

The great bulk of kaolin, or china clay, used in the potteries of the United States is mined in this section. The amount of prepared clay shipped last year was nearly twenty thousand tons.

Kaolin results from the decomposition of a rock composed of feldspar and quartz; and is found in pockets or beds, in low and very often swampy ground (I speak of kaolin found in this vicinity), the clay underlying the surface soil holding the water. The amount of covering varies; in some cases being less than eight feet from the surface, and in others as much as forty. The pockets are of an oblong shape, the general direction being northeast and southwest. The kaolin is found bedded against veins of talc, which determine the width of the pocket. The talc is very irregular in its pitch, but eventually cuts the clay out. The talc is in turn bedded against partly decomposed mica schist, and very often against a vein of iron or manganese.

There are no surface indications of kaolin, and it is generally proved by boring, or sinking small shafts. After having determined the position of the deposit, the dirt is stripped off and the clay uncovered, and taken out by means of carts, cars, or derricks, as the case may be. From the situation of the pit, which is generally in the lowest ground, there is no opportunity for drainage after you are down any depth, and constant pumping becomes necessary, not only of surface water, but of large springs, which burst out from the sides of the pit and through the banks.

The clay is taken from the pit to the washing machine, which is a three or four inch shaft, according to the power you have, placed horizontally with knives at right angles, about four inches apart, made of three-inch by inch iron, twelve inches long. The whole is enclosed in a stout framework, with a pulley at one end of shaft connected by belt with main shaft, and an opening made at the other end of the machine for the escape of the clay and sand. The shaft is set in motion, a stream of water turned on, and the clay thrown in the top as fast as a man can shovel it. The sand or quartz coming out with clay and water settles in a box, where it is continually being shoveled out.

The clay, combining with water, and of the thickness of cream, is allowed to run slowly off into a number of troughs for a time, until all the impurities have had a chance to settle. It is then turned into large vats, where it remains until quite thick. It is then pumped into presses, which are a number of wooden panels held together by iron rods—each panel containing a canvas bag. The water escapes through the pores of the canvas, and leaves the clay in such a condition that it can be handled and placed on shelves in the open air to dry, after which it is ready for shipment.

Kaolin, both in a crude state and washed, is much improved by exposure. If placed in piles, and allowed to freeze and thaw during the winter, it will be found much tougher in the spring. A strong, tough clay is of much more value to the potters, as it enables them to make thinner ware. It is said that in the manufacture of the finest ware, in China, one generation mines the clay for the next to use.

The average yield of washed koalin from a ton of crude clay is from thirty to fifty per cent. I have never seen crude clay in any quantity which would yield above that.

The quartz, washed from the crude clay, is of the purest nature; and when pulverized is worth about $12.00 per ton, and is sold to the potters—they using it in the body of their ware, and also with feldspar as as a glaze.

The mica or talc which is washed from the clay, and settles in the troughs, makes a good fire brick.

In conclusion, to give a general idea of the size of the deposits of kaolin in this section, I would say that in the pit I am now working, the clay had been proved at a depth of ten to sixteen feet from the surface, for over 300 feet in length and 80 to 100 feet in breadth; and in depth 50 feet, and still clay. The greatest depth I have ever been down, in any of my pits, is ninety feet, the strata of clay continuing, but which had to be abandoned on account of the expense of keeping the dirt from caving in.

The color of kaolin varies from a pure white to a yellow (as shown in the specimens), the white being more valuable. The yellow and the white clay are often found banked against each other, and running vertically downward, side by side. The clay is hard to excavate, and requires the strongest steel pointed shovel for work, being dug in sods.—*Proc. Eng. Club.*

Cements for Special Purposes.

The value of a cement is, first, that it should become a strongly cohering medium between the substances joined; and, second, that it should withstand the action of heat, or any solvent action of water or acids. Cement often fails in regard to the last consideration. For waterproof uses several mixtures are recommended, and the following may be mentioned:

One is to mix white lead, red lead, and boiled oil, together with good size, to the consistency of putty. Another is powdered resin, 1 ounce, dissolved in 10 ounces of strong ammonia; gelatine, 5 parts; solution of acid chromate of lime, 1 part. Exposing the article to sunlight is useful for some purposes. A waterproof paste cement is said to be made by adding to hot starch paste half its weight of turpentine and a small piece of alum. As a cement lining for cisterns, powdered brick 2, quicklime 2, wood ashes 2, made into a paste, with boiled oil, is recommended.

The following are cements for steam and water joints: Ground litharge, 10 pounds; plaster of Paris, 4 pounds; yellow ocher, one-half pound; red lead, 2 pounds; hemp, cut into one-half inch lengths, one-half ounce; mixed with boiled linseed oil to the consistency of putty. White lead, 10 parts; black oxide of manganese, 3; litharge, 1; mixed with boiled linseed oil.

A cement for joints to resist great heat is made thus: Asbestos powder, made into a thick paste, with liquid silicate of soda.

For coating acid troughs, a mixture of 1 part pitch, 1 part resin, and 1 part plaster of Paris is melted, and is said to be a good cement coating.

Correspondents frequently ask for a good cement for fixing iron bars into stone in lieu of lead, and nothing better is known than a compound of equal parts of sulphur and pitch. A good cement for stoves and ranges is made of fireclay with a solution of silicate of soda. A glue to resist damp can be prepared with boiled linseed oil and ordinary glue; or by melting 1 pound of glue in 2 quarts of skimmed milk; shellac, 4 ounces; borax, 1 ounce, boiled in a little water, and concentrated by heat to paste. A cement to resist white heat may be usefully mentioned here: Pulverized clay, 4 parts; plumbago, 2; iron filings, free from oxide, 2; peroxide of manganese, 1; borax, one-half; sea salt, one-half; mix with water to thick paste, use immediately, and heat gradually to a nearly white heat.

Many of the cements used which are exposed to great heat fail from the expansion of one or more ingredients in them, and an unequal stress is produced; or the two substances united have unequal rates of expansibility or contractility; the chemical or galvanic action is important. The whole subject of cements has not received the attention it deserves from practical men. Only Portland cement has received anything like scientific notice, and a few experiments upon waterproof, heat-resisting, and other cements would show which cements are the best to use under certain circumstances. —*Van Nostrand's Magazine.*

A Russian Bath at Home.

Among the new home conveniences recently introduced, is a simple attachment to the ordinary bath tub, by which the luxury of a vapor or medicated bath may be taken in one's own house.

To persons who enjoy the luxury of the Russian bath, but do not reside where such establishments are accessible, the new vapor appliance is a good substitute.

The medicating or disinfecting materials are placed within cylindrical air chambers, and fed drop by drop into the water, and mingle with the steam as it is drawn into the bath tub. The invention has been introduced into some of our city hospitals, and a number of physicians have recommended it for its capability as a deodorizer and disinfecter. A bath may be perfumed by a few drops of any odorous extract, put into the cylinder with the other ingredients. Handsome rooms have been fitted up for exhibiting the practical workings of the new bath apparatus at No. 12 East 23d Street, New York, and persons residing out of the city who may desire to know more about the invention can gain information by addressing John Ponder, at the above place.

Heavy Electric Light Suits Coming.

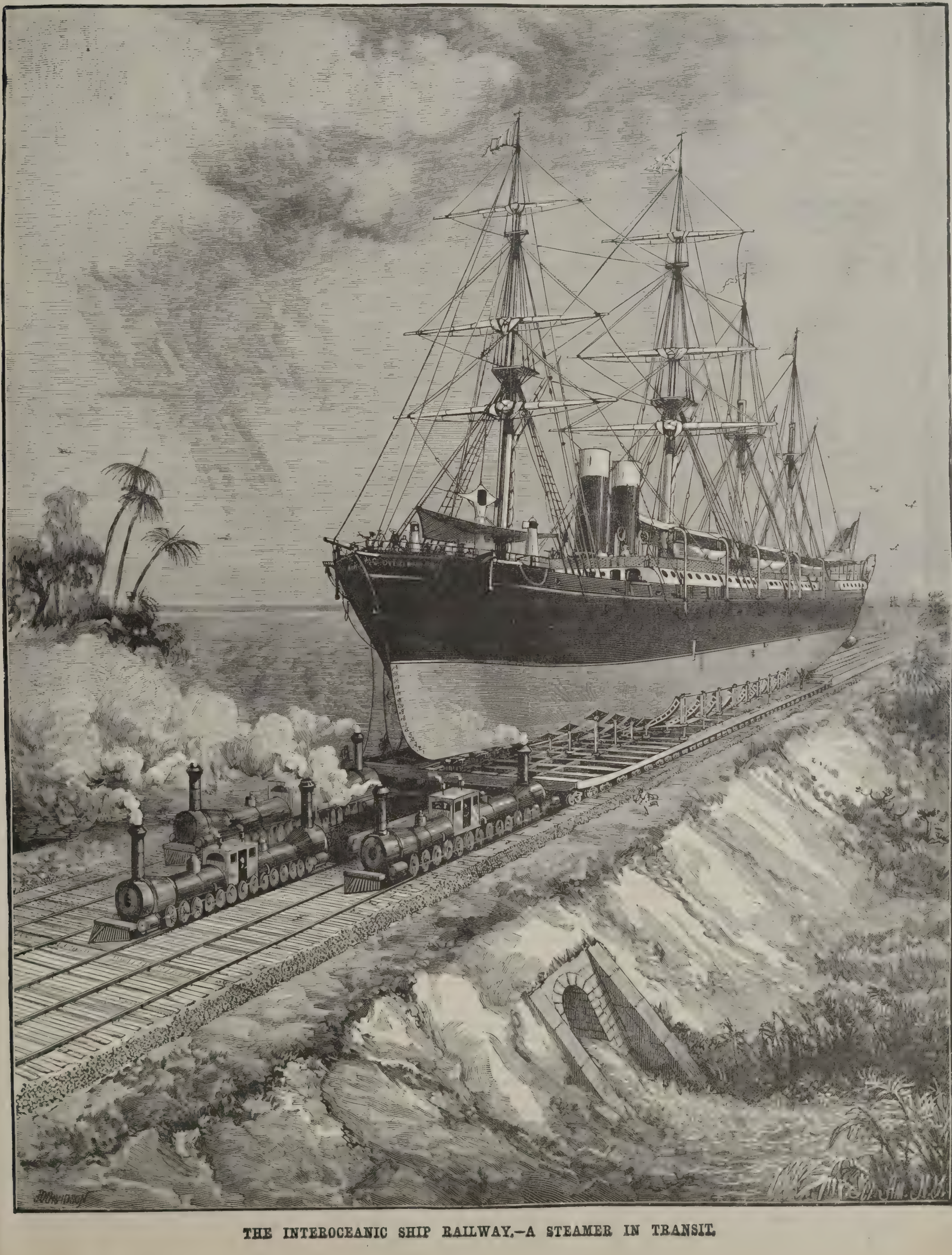
The Edison Electric Light Company have commenced suits against alleged infringers on their patents for incandescent electric lighting on a scale which promises to give a large number of lawyers a fine field of labor. The various companies made defendants are the U. S. Electric Lighting Co., the U. S. Illuminating Co., the Consolidated Electric Light Co., the Swan Incandescent Electric Light Co., the Remington Electric Light Co., and the Schuyler Light Electric Co., besides a few prominent users, who, in patronizing these various companies, to this extent dispute the validity or force of the Edison patents.

Loads on Roofs.

The load to which a roof is exposed is of two kinds: first, that due to the weight of the materials; and second, that due to the wind, or its vertical pressure. The first increases with the span, and must be estimated from tables of the weight of the materials used. In the second category the vertical component of the wind has to be considered, calculated about 40 lb. per square foot. For ordinary roofs the following data have been given per square foot: 5 lb. for weight of truss, 5 lb. for purlines, etc., 10 lb. for slate, and 36 lb. for wind, making a total pressure of 56 lb., or ½ cwt., about 1-40 ton, per square foot. For very large roofs these figures ought to be increased, and we may usefully refer to the figures used for the St. Pancras station roof, as given by Mr. Barlow. Here the total estimated pressure, exclusive of the weight of truss, was taken at 80 lb. per foot, and this was made up as follows:

The truss 10 lb. per square foot, covering 36 lb., wind 34 lb. The calculation of the strains can be obtained by analytical or graphical means, both of which methods are described in handbooks which treat of these matters. It is convenient to suppose this total load concentrated at certain points, such as the foot of rafter, the apex of roof, and a point midway between. Whatever the weight may be on each rafter, half of it will be discharged at each of the two extremities if we regard it as a rigid beam. But if we divide the length, the middle or purline point will receive double the share of weight discharged at the foot. There will, in fact, be equal weights at the apex and the purline point, but half only at the foot of rafter. In short, at the apex and purline point the loads are doubled, owing to the bearings of two adjacent lengths coming together. Thus, if we put five at the foot of rafter, we must put ten at the purline point and ten at the apex of roof.—*Building News.*

THE total number of deaths from smallpox in Montreal during the late epidemic exceeds 3,000, distributed among over 500 houses.



THE INTEROCEANIC SHIP RAILWAY.—A STEAMER IN TRANSIT.

THE INTEROCEANIC SHIP RAILWAY.

The transisthmian projects which for many years have attracted the attention of engineers may be divided, perhaps not improperly, into three classes: 1st. Those in which the construction will be at the mercy of floods. 2d. Those lacking good harbors. 3d. Those which empty into the Doldrums or Zone of Calms. Of these three fatal objections, the Panama tide water canal scheme is open to the first and third, and the Nicaragua lifting-lock plan to the second and third. The ship railway project of Mr. James B. Eads, illustrated in this number, is open neither to the one objection nor to the other, and besides being far less costly, it furnishes a quicker means of isthmian transit than either of them, and will shorten by considerably over a thousand miles the contemplated route *via* Panama between our Atlantic States and San Francisco or the East Indies.

Until the arrival in the field of Mr. Eads, it seemed to have occurred to no one that anything but a waterway would serve for ship transit between the two oceans. It did not appear impracticable to some of the transisthmian projectors to build a ship canal in a region annually inundated by mountain streams, or to expect sailing vessels to traverse hundreds of miles of wind-bereft seas. But to take ships across a narrow isthmus by rail was monstrous, and not to be thought of.

It is no part of the purpose of this article to cast discredit upon the rival projects of Panama and Nicaragua, but the promoters of both the one and the other, in very laudable efforts in support of their own theories, have led at least a portion of the unthinking public to look upon the ship railway scheme as impracticable and visionary, and a comparison is necessary to show the relative practicability of the ship railway and the two most prominent canal schemes, and its superior advantages when considered from a commercial standpoint. In making this comparison, however, we shall endeavor to give each its just due, setting down naught in malice.

A careful study of the engravings as presented in this number, and the explanation which accompanies each, will show that while the ship railway is novel and original when taken as a whole, it demands no other methods in the treatment of a ship than those usually employed in the dry dock and the marine railway, and which experience has shown to be safe. Indeed, the only remarkable thing about the scheme is that no one has ever thought of it before.

In the ship railway project a ship is lifted out of the water by means of a submerged pontoon, similar to those in use all over the world; but no such force as that used in hauling a ship up out of the water on a marine railway is required on the ship railway, although, as well known, ships are constantly taken on the marine railway without injury. In the Eads system, however, there is no necessity for using any force whatever on the ship itself.

It is lifted out of the water in a cradle which rests upon a series of rails; and these being brought even with the tracks on the dry land, the cradle in its capacity of a car is wheeled along an almost level railway across the Isthmus of Tehuantepec, and when it reaches the other side a similar means is employed to float it again. This is the whole project —a combination of the lifting dock in general use and an improvement upon the marine railway, because the ship is never, as in the latter, required to be off an even keel.

Looking upon the chart, we find that the Isthmus of Tehuantepec is in Mexico, and in the extreme northern end of the long, slim neck of land which separates North from South America, and that the Isthmus of Panama is on the extreme south end of Central America, and at the farther end of this strip of land. Having discovered this, we naturally turn to a consideration of ocean lanes from the Atlantic and Gulf States to California and the East Indies, and from California to the British Islands, because, in these days of expedition, the shortest route, all else being equal, is sure to prove the most popular. We have not proceeded far in this inquiry when the advantages of the Tehuantepec route in time and distance become plainly apparent.

From New York to San Francisco *via* the Panama Canal, a steamship would be compelled to pass the Isthmus of Tehuantepec, sail south a long distance, and after crossing sail north again the same distance before reaching the short route to San Francisco. In other words, she would have to traverse about 1,200 miles more than if she had crossed the isthmus at Tehuantepec. From Gulf ports to San Francisco and the East the difference in distance in favor of Tehuantepec is still more marked; the route between New Orleans and San Francisco *via* Tehuantepec being about nineteen hundred (1,900) miles shorter than *via* Panama. From Liverpool to San Francisco there is a saving of 600 miles *via* Tehuantepec. With sailing vessels—and sailing vessels, much as we hear of steamers, carry fully three-quarters of the world's freights to-day, and are likely to continue to carry slow freights—the contrast is still more marked.

A sailing vessel having crossed the Isthmus *via* Panama is left in a very ocean of waters, over which reigns a perennial calm, broken only by occasional squalls and baffling zephyrs. She must be towed hundreds of miles until the region of the trade winds is reached. This, of course, serves to add a large expense to the voyage and to lengthen it many days, so that when we say the voyage between the Atlantic States and California is shorter by 1,200 miles *via* Tehuantepec than it is *via* Panama, we greatly underestimate the advantages of the former route. It would be a generous estimate to allow for only ten days'—good authorities say from 20 to 30 days'—delay between the Pacific side of the Panama Canal and the point where a sailing ship strikes the northeast trades, by reason of calms and the slow progress made while in tow. Allowing that a sailing ship can average 170 statute miles in a day's run, this would add 1,700 miles to the 1,200 miles extra run required *via* Panama, and hence would serve, practically, to make the Tehuantepec route 2,900 miles shorter in the run from New York to San Francisco, and 3,500 miles shorter in the run from New Orleans to San Francisco.

In confirmation of this, indeed, as showing that in the above we have underestimated the time required by sailing vessels *via* Panama to cross the calm zone, we append herewith the testimony of a practical seaman, Captain Silas Bent, as given before the Merchants' Exchange in St. Louis, pending the unanimous adoption by that body of the resolution recommending a favorable consideration of the ship railway to the United States Government:

"Mere statements of the difference in miles is a very inadequate measure," he says, "of the difference in time that would be occupied by sailing vessels in making these several passages; and when we consider that three-fourths of the ocean commerce of the world is carried in sailing vessels, you can see what an important factor this question of *sailing time* becomes in the solution of the problem before us.

"The northeast trade winds which extend across the Atlantic are so broken and interrupted when they encounter the West India Islands that they never penetrate the Caribbean Sea; but the northwest portion of them, however, do extend into the Gulf of Mexico, and often so far down as to reach well toward Tehauntepec, so that while in the Gulf winds are always found, yet the Caribbean Sea remains a region of almost relentless calm.

"Nor is this all, for the mountain ranges, extending the length of the Isthmus of Panama and through Central America, offer a still more formidable barrier to the passage of these winds, thus throwing them still higher into the upper regions of the atmosphere, and extending these calms far out into the Pacific Ocean, on the parallel of Panama, with lessening width, for fifteen or eighteen hundred miles to the northwest, along the coast of Central America.

"This whole region of calms, both in the Caribbean Sea and in the Pacific Ocean, is so well known to navigators that sailing vessels always shun it, if possible, though they may have to run a thousand miles out of their way to do so.

"This absence of wind, of course, leaves this vast area exposed to the unmitigated heat of a torrid sun, except when relieved momentarily by harassing squalls in the dry season and by the deluging rainfalls of the wet season. With these meteorological facts in view, let us now suppose that the Lesseps canal at Panama and the Eads railway at Tehuantepec are both completed and in running order; then let us start two sailing ships, of equal tonnage and equal speed, from the mouth of the Mississippi, with cargo for China, one to go by the way of the Panama Canal, and the other by the way of the Tehuantepec Railway, and I venture to affirm that by the time the Panama vessel has cleared the canal and floats in the waters of the Pacific, the Tehauntepec vessel will have scaled the Isthmus and be well on to the meridian of the Sandwich Islands; and that before the former vessel can worry through the fifteen or more hundred miles of windless ocean before her, to reach the trade winds to the westward of Tehuantepec, the latter will have sped five thousand miles on her way across the Pacific, and be fully thirty days ahead of her adversary. For it is a fact worth mentioning here, that the strength of the northeast trade winds in the Pacific, as well as the maximum strength of the northern portion of the great equatorial current in that ocean, are both found on or near the parallel of latitude of Tehuantepec, the former blowing with an impelling force to the westward of ten or twelve miles an hour, and the latter with a following strength of three or four miles per hour."

It is not to be supposed that Mr. Eads hit upon the plan of his railway before carefully studying the various canal projects; such was not the case. It was, in fact, the result of these canal studies which led him to seek some other means of crossing the narrow strip of land that separates North from South America. For to his practical mind neither the one canal project nor the other of them gave evidence of feasibility, owing to their excessive cost. It was a great problem to solve! Here were a paltry forty or one hundred miles of earth and rock, which, if pierced, would serve to shorten by ten thousand miles the present voyage *via* Cape Horn from New York to San Francisco, which now is 15,687 miles, and to reduce the distance by water between New Orleans and San Francisco from 16,112 miles to something less than 4,000 miles.

It is not surprising that the mind that conceived the jetty system, as applied to the mouth of the Mississippi River, should not be thwarted by the obstacles which confront the transisthmian projector; nor is it surprising to find that the plan that he has hit upon is thoroughly original, or that it is decried by those who do not understand it. Indeed, it would be more surprising if this were not the case; for have not all original schemes been laughed at? The idea, when first proposed, of forcing carbureted hydrogen illuminating gas through the London streets furnished no little amusement to the illuminati; when the project of sending a vessel across the ocean to England propelled by steam was first made public, an eminent scientist was so sure of the impracticability of the scheme that he promised to swallow the vessel on its arrival; when Captain Ericsson proposed to substitute for the direct action of the paddle wheel the oblique action of the screw, he was looked upon as bereft of reason. Yet all succeeded.

"Whatever is attempted without previous certainty of success," says an eminent writer, "may be considered as a project, and among narrow minds may, therefore, expose its author to censure and contempt; and if the liberty of laughing be once indulged, every man will laugh at what he does not understand, every project will be considered as madness, and every great and original design will be regarded as impracticable. Men unaccustomed to reason and researches think every enterprise impracticable which is extended beyond common effects, or comprises many intermediate operations. Many who presume to laugh at projectors or designers would consider the navigation of the air in a flying machine as the dreams of mechanic lunacy, and would hear with equal negligence of the accomplishment of the Northwest Passage and the scheme of Albuquerque, the Viceroy of the Indies, who, in the rage of hostility, had contrived to make Egypt a barren desert by turning the Nile into the Red Sea."

Mr. Eads knew that ships had been going on and off lifting docks without injury from time immemorial, and that vessels that could safely withstand the terrible buffeting of ocean waves could be moved over a smooth roadbed without fear of injury. In order to be sure as to the roadbed, he took with him, to the Isthmus, Mr. J. J. Williams, an able engineer, who had made several surveys for interoceanic railroads and canals, and Mr. E. L. Corthell, who had successfully carried out his plans at the mouths of the Mississippi, and is an expert in railroad construction, having been chief engineer of the West Shore Railroad. Being a practical man, Eads naturally sought to discover a route that would furnish a substantial roadbed, possess something in the shape of harbors at either end, and above all a location outside of that, to the mariner, vexatious belt of perpetual calm. He found a cross section of the Isthmus of Tehuantepec which combined all these qualities; nay, more, for of all the routes across the narrow strip of land joining Mexico with South America, none shortens so much as this the voyage from the Atlantic and Gulf States to California.

Having selected the site for his ship railway, he now sought a concession from the Mexican Government. This was obtained in 1881, and extends over a period of ninety-nine years from its date. It authorizes the construction across the Isthmus of Tehuantepec of a ship railway, an ordinary railway, and a line of telegraph. Besides this it exempts all ships and merchandise *in transitu* from government duty, grants the concessionaire a million acres of public land, and guarantees protection during the construction and subsequent operation of the works. To crown all, the right is given the company to obtain the aid of any foreign government, and in consideration of this assistance the company is authorized by the terms of the concession to discriminate in favor of the commerce of such government against that of all other countries, save, of course, Mexico. The concession obtained, Mr. Eads set about having a careful survey made, topographical and physical, for the several previous surveys were with reference to a canal or an ordinary railway. One of the Eads surveys was made by Mr. Williams, one by Mr. Corthell, and another by a party of engineers under the direction of Don Francisco de Garay, an able Mexican engineer, with forty assistants and linemen; he being assigned by the Mexican government to assist Mr. Eads in making the survey. Two lines were run over the mountains, and a careful hydrographic survey was made of the approaches of the termini. A series of additional surveys were recently made from Minatitlan to Bocca Barra and to Salina Cruz, by Mr. Martin Van Brocklin, of large experience in Spanish-American countries in locating and building railroads, and by Mr. Deming J. Thayer, an accomplished civil engineer.

The length of the whole railroad line will be about 134 miles from Atlantic to Pacific. Beginning on the Atlantic side, the route will start from the Gulf of Mexico, the ships sailing up the Coatzacoalcos River to Minatitlan, a distance of about 25 miles. From Minatitlan there extends for about 35 miles an alluvial plain having an underlying stratum of heavy, tenacious clay. On the high land and ridges clay, loam, and sand are found. Next comes an undulating table land, and then irregular mountain spurs of the main Cordilleras, that run through the entire continent, making at this point one of the most marked depressions to be found in its whole length. From this basin the line passes through a valley formed by a small stream to the plains of Tarifa, where is situated the summit of the line. This is 736 feet above low tide. After traversing these plains, the Pass of Tarifa is reached. This is the most accessible of the many passes in this depression in the mountain chain. From here the line gradually sinks to the Pacific, reaching the plains on this side 118 miles distant from Minatitlan.

The pontoon, or floating dock (see Figs. 1 to 4), is of the same general construction as those in use all over the world, save in some important modifications rendered necessary to fit it for its special work. For it is not enough that the vessel should be docked and lifted out of the water, but that it shall be caused to rest upon a cradle in such a manner that its weight shall be equalized fore and aft, and thus enable the carriage with its load to move easily and safely. This is effected by means of a system of hydraulic rams arranged along an intermediate deck about six feet below the upper deck of the pontoon (see Fig. 2). The arrangement of the rams is in both lateral and longitudinal lines, the former standing a little less than seven feet apart, the one from the other. The area of the combined rams in each lateral line is the same; the area of the one ram under the keel forward or aft is equal to the area of the five or seven rams amidships. They may be connected and made to work in unison, so that the same pressure per square inch of surface of the rams will exist throughout the whole system, or they may be disconnected by valves, so that a greater pressure may be brought upon the rams in a certain section or on a certain line.

It is no part of the duty of these rams to lift the vessel,

They are designed only to resist its weight as it gradually emerges from the basin. They get their power from a hydraulic pump placed on a tower affixed to the side of the pontoon, and rising and sinking with it, but of such a height that, even when the pontoon rests upon the bottom of the dock, it is not entirely submerged. The pontoon itself is directed by powerful guides, which cause it to descend and emerge from the water always in the same position.

A ship having entered the mouth of the Coatzacoalcos River, on the Atlantic side, and come up to the basin, the carriage with its cradle is run on to the floating dock, then water is let into the compartments of the pontoon, and dock and cradle gradually sink to the bottom. Then the ship is brought in from the exterior basin, and so adjusted as to position that her keel will be immediately over the continuous keel block of the cradle, and her center of gravity over the center of the carriage. The water is then pumped out of the submerged pontoon in the manner employed in floating dock systems, and it rises gradually, bringing the cradle up under the ship's hull (see Fig. 2). As soon as the keel block of the cradle is close to the ship's keel, the hydraulic pump is called into action, and pushes up the pendent rods and posts of the supports gently against the vessel, closely following the lines of her hull and the run of the bilge. The pressure upon the rams increases as the vessel emerges from the water, but the water pressure under them being prevented from escaping by the closing of the valves, the ship's weight, when she stands clear of the water, is borne by the rams by means of the supports.

In the case of a ship weighing five thousand tons, each of the fifty lines of rams would, of couse, be called to sustain a burden of exactly one hundred tons; and these lines being placed at equal distances the one from the other, it will readily be seen that each unit of the ship's weight is equally distributed. The weight and displacement of the vessel is learned from the pressure gauge on the hydraulic pump.

The vessel being clear of the water, hand wheels or adjusting nuts that move in threads cut in the columns of the supports are run down to the bearings on the girder plates, whereupon the valve is opened and the rams withdrawn, leaving the girders to support the weight of the ship. Now each girder has the same number of wheels, and as described above bears its just proportion of weight and no more, hence each of the multitude of wheels under the carriage is called upon to bear the same weight. This weight has been calculated to be only from eight to nine tons, though the wheels will be tested to twenty. One of the many ingenious contrivances in the scheme is the "hydraulic governor," so called, and by which the unevenness of the plane of the pontoon when it is rising or falling with its load can be readily corrected. This apparatus is thus described:

"Two cylinders are attached to each corner of the dock, one being upright and the other inverted. Plungers attached to the pontoons move in them. The two cylinders on diagonal corners are connected by pipes, and all spaces in the cylinders and pipes are filled solid with water. As the pontoon rises, the water forced out of one cylinder by the ascending plunger is forced into the inverted cylinder on the diagonal corner where the plunger is being withdrawn. Now, if there is, say, one hundred tons preponderance on one end of the pontoon, one-half this weight, or fifty tons pressure, will be exerted by each plunger on that end upon the water in its cylinder. This pressure is instantaneously transmitted through the pipes to the water in the top of the upright cylinder on the diagonal corner, which acts with the same amount of pressure as a water plunger upon the metal plunger to hold it down; thus an equilibrium is maintained, and the pontoon compelled to rise and fall perfectly level. It is possible by aid of a pressure gauge attached to the pipes to ascertain the exact amount of the excess of weight, so that, should this gauge show too great a preponderance, the pontoon must be lowered and the ship placed in a new position."

The pontoon cannot elevate the rails on its deck above what would be a prolongation of the rails ashore, because of the heads of the anchor bolts or guiding rods, and these will also prevent any tipping of the pontoon when the ship-burdened cradle is moving off. The carriage with its cradle which comes up upon the submerged dock, is calculated to hold a ship even more firmly than the launching cradle used at the ship yards, with its shores and stays. This carriage moves upon six rails, three standard gauge tracks each of 4 feet 8½ inches. Ships themselves are girders, and must of a necessity be so, from stem to stern, because in the tempestuous seas in which they are designed to roam, the one part is constantly being called upon to support the other; now her bow projects over a great billow with nothing under to support it, and again she is poised upon a huge wave, leaving the midship section to support in great measure both the bow and the stern; and were she not constructed as a girder fore and aft, her back would be broken in the first big seas she encountered. Comprehending this, the designers of the ship carriage make its strength reach its maximum in the cross girders, which are spaced like the lateral lines of the rams already described; that is to say, seven feet apart, and having sufficient depth and material in their plates to insure an equal deposit of weight upon all the wheels. These latter are double flanged and are placed close together, each being hung independently on its own journals, and having its own axle. Under an ordinary railway car the four or six wheel trucks move together about a central pin. But in the ship carriage, which is not designed to move off from an almost straight line, this is not required, and greater strength is obtained by adhering to the rigid principle; elasticity being had by placing a powerful spring over each wheel. These springs will, as said before, bear a weight of twenty tons and have a vertical movement of about six inches, while the maximum weight they will be called upon to bear will not depress them more than three inches, and allow for crossing irregularities without bringing an undue weight upon the wheels.

There is also a system of supports for the vessel, each having adjustable surfaces hinged to the top of the supports by a toggle joint in such a way that they may be made to closely follow every depression and yield easily to every protuberance or bulging. They pierce the girders of the carriage, and are exactly pendent over the hydraulic rams when the carriage is on the pontoon and rests in its proper position. Thus, as will be seen, the ship when crossing the Isthmus (see frontispiece) rests upon what might be called a cushion, and indeed she will have experienced far rougher treatment, both in the Atlantic and Pacific under only ordinary conditions of weather, than that had while *in transitu* by rail across the Isthmus.

As said before, the road is designed to be almost exactly straight, since there will be no curves having a radius of less than twenty miles, for the carriage is four hundred feet long, and rests upon wheels which, as already explained, are not set on trucks swinging to a common center. There are only five places in the whole line where it is necessary to deviate from a straight line, and at each of these places a floating turntable (see Figs. 5 to 7) will be built. These turntables in design resemble pontoons, for they rest upon water, and will be strong enough to receive the carriage and its burden. The turntable-pontoon will be firmly grounded upon the circular bearers of the basin, when the carriage is run upon it, by the admission of water. This is pumped out by a powerful centrifugal pump, the water being drawn through the cylindrical pivot of the pontoon, which is hollow, and discharged into the basin. When the pontoon has been made sufficiently buoyant to be turned easily upon its pivot by steam power, the ship carriage is then quickly pointed in its new direction. The valves then permit the water to enter once more, and the pontoon turntable again rests on its bearings. These turntables may be made to serve another purpose. By their means a ship can be run off on a siding, so to speak, where she can be scraped, painted, coppered, calked, or otherwise repaired without removal from her cradle, and thus be saved the heavy expense of going on a dry dock.

The locomotives for hauling the ship carriage over the Isthmian railway will not differ from those in ordinary use, except that they will have about twice the traction power of the most powerful locomotives that run on ordinary railroads. The big freight engines of the day have no difficulty, as we know, in drawing freight trains of a total of fifteen hundred tons; and as the ship carriage moves along three tracks it would be easy, if such a course were necessary, to place three locomotives in front of it and three behind. The time estimated for crossing from ocean to ocean is only 16 hours.

Having now been over the ground of the ship railway and examined its several engineering features, let us turn to consider from the same practical standpoint the plans on which it is proposed to construct the rival projects at Panama and Nicaragua.

We have seen that, in the proposed Interoceanic Ship Railway, no really new or startling engineering problems present themselves. Is this the case with the canal projects? Let us see. At the International Canal Congress in Paris, in May, 1879, the Panama plan was rushed through despite the protests of the American and English delegates, who insisted that it was altogether impracticable. A simple reconnaissance had been made by Lieut. Lucien Wyse, and this was given precedence by the French over the many and careful surveys which have been made by skillful American engineers and by engineering expeditions from other countries.

It was evident from the start that the French had made several serious miscalculations. They had not given sufficient weight to the deadliness of the climate in that part of the Isthmus and the extent of the floods—two factors, as we shall see, which, if they do not finally prove an effective barrier to the progress of the work, are sure to greatly retard it and render its construction so costly as to make it, at the best, but a sorry venture from a financial standpoint. When nearly two-thirds of the whole appropriation for the canal was expended, and about one-thirtieth of the work performed, a startling discovery was made. The course of a great river, the Chagres, must be turned, and some means found of diverting the mountain streams, before active work on the canal proper could be resumed. Now, the Chagres River, so say expert engineers who have been on the ground, will require an immense expenditure of money—$20,000,000 at the least—to dam it at Gamboa, and a dam 150 feet high; also a lateral channel to divert these impounded waters *thirteen miles in length and as large as the main canal*, for there will be twenty million cubic meters in it.

Some idea of the destructive powers of this Chagres River may be had from the fact that, in 1879, during an unusual freshet, it flooded its entire valley for thirty miles; there being eighteen feet of water on the line of the Panama Railroad. The lateral canals for carrying off the water are likely to prove dangerous as well as expensive. As to these Colonel John G. Stevens, of New Jersey, one of the most eminent and experienced canal engineers in the country, and who visited Panama some two years since for New York capitalists, says: "Being situate in a depression of the Cordilleras, and flanked on each side by lofty mountain ranges, with steep sides, all water drains rapidly into the valley. Then again the rainfall of the tropics is excessive, and with us would be called phenomenal; at times being six inches in twenty-four hours for days in succession. The river consequently rises rapidly, and the greater part of the valley is submerged. . . . I think I can say that but one efficient plan can be formed, and that is to construct drainage canals on each side of the valley, so as to intercept the water that will drain from the mountain ranges on each side. Now, in severe floods the surface waters of these canals will be about seventy feet above that of the canal proper; consequently heavy guard banks will require to be constructed to restrain these intercepted floods. In other words, *the water will have to be hung up on the sides of the mountains.* Of course, with such a pressure, there will always be a great risk of the water breaking through the banks and the canal so filled by sediment as to stop navigation until it is removed. This would necessarily be a work of time, and destroy the prestige of the canal as an avenue of transport. . . . I do not remember ever to have seen money expended and such slight results effected; but I wish to add that this was evidently not due to the gentlemen in immediate charge, who were capable and zealous."

From evidence furnished by other expert engineers who have visited this region, it may be safely predicted that the wash from the slopes (clayey) in the profuse rainfall of this tropical region will tend to fill up the canal and entail a large expense in removing material.

The original estimate of the quantities of material to be removed has, of course, been greatly increased by the proposed Chagres River dam and the diverting channel back of it. Prices for labor, since the deadliness of the climate has come to be realized, have advanced to double and even thrice their original figures, and excavation which at first was done for 30c. per cubic meter advanced last year to 90c.; 10,000,000 cubic yards, mostly soft dredging in the terminal marshes, has been done in four years. But even suppose they can do 6,000,000 cubic yards of dredging and rock excavation per year—and this is surely a generous estimate—then $\frac{1}{6}\frac{0}{}$=33 years to complete the canal. The original estimate was from $120,000,000 to $170,000,000, but with the obstacles now in view, and considering that the rock work has hardly been touched, $200,000,000 would seem to be a not unreasonable figure which the work will have cost when performed.

Let us now turn to the Nicaragua scheme. This project is for a lifting-lock canal—from 17 to 20 large locks being required. The time necessary to cross from ocean to ocean would probably be about three days. The location is 800 miles farther south than Tehuantepec, and consequently far south of the shortest route to California and the far East. It is situated also in the calm zone and in a country frequently visited by earthquakes, and hence liable at all times to serious injury.

The harbor of Greytown (north side) is irretrievably ruined, and Major McFarland estimates that it will cost $14,000,000 to make a good harbor of it. The harbor of Brito, as it is called, at the point where the Rio Grande enters the Pacific, is in fact only a small angular indentation of the land, partially protected by a low ledge of rocks, entirely inadequate for the terminus of a transisthmian canal and incapable of answering the commonest requirements of a port.

No reliable estimate of the expense of the Nicaragua canal has fallen short of $92,000,000; the Government Commission estimated $100,000,000, and Major McFarland $140,000,000, in which the estimated cost for labor is only $1 per day, an amount altogether too small, as shown by the present prices at Panama. The complication with England, too, makes the Nicaragua route to a great extent objectionable. By the Clayton-Bulwer treaty, made with England in 1850, we pledged ourselves to exercise with her only a joint control over any canal that should be built at this point, then looked upon as a favorable position for a canal because at that time there was a good harbor at Greytown. (The natural breakwater was destroyed by the sea in 1859, and the harbor filled up and ruined.) Only two years ago, as we know, England reasserted her claims, and insisted that the terms of the treaty should be complied with. In the recent concession made by Nicaragua, the government of the latter country makes the modest demand for *one-third the tolls collected*, should the canal be built.

The cost of the ship railway as computed by expert engineers will be about fifty million dollars ($50,000,000).

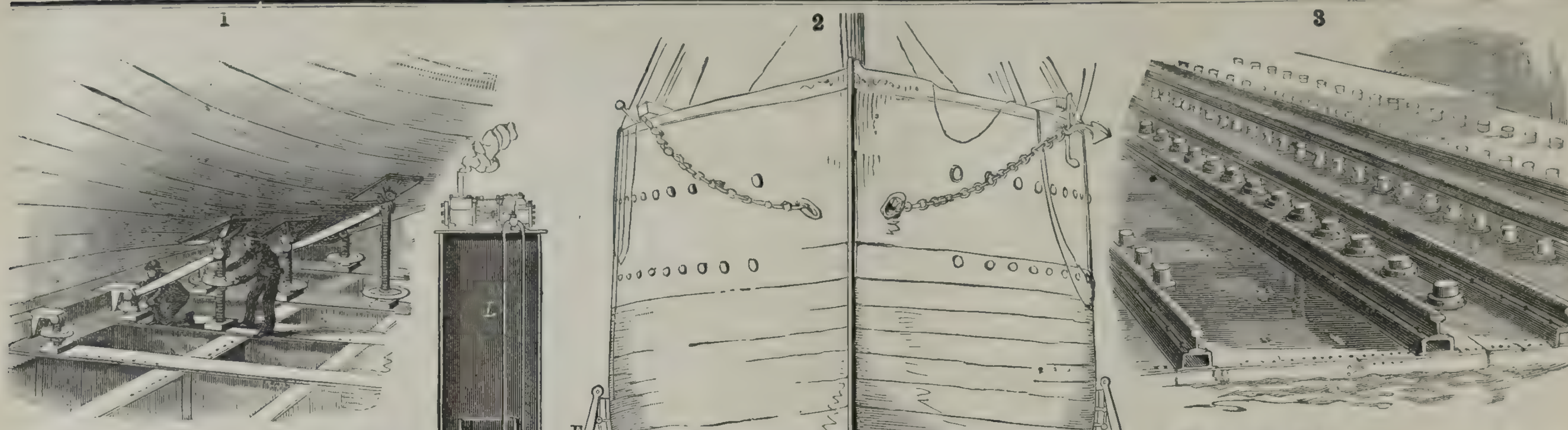
A careful estimate has shown that it would not be unreasonable to look for a gross tonnage of 5,000,000 tons in 1888 for any passage across the Isthmus. Four dollars the ton would be but a moderate charge—the Panama Railroad demands $15 a ton. This would give $20,000,000 as gross receipts. Now, it has been estimated that 40 per cent of this would pay all working expenses, thus leaving $12,000,000 as net profit, or 12 per cent on a capitalization of $100,000,000.

The Tehuantepec ship railway is a private enterprise that does not ask a dollar from the government, and there will be little trouble in its construction if the government does not by legislation or by committing itself to the Nicaragua canal scheme injure its prospects and defeat its aim, which is, to furnish a cheap, rapid, and safe passage for ships across that narrow strip of land which heretofore has proved an effectual barrier to aspiring canal builders.

The company supporting Mr. Eads, and which owns the concession granted by Mexico, is composed of some of the most wealthy and influential men in Pittsburg, St. Louis, New Orleans, and other cities. They are thoroughly in earnest, and determined to build the ship railway.

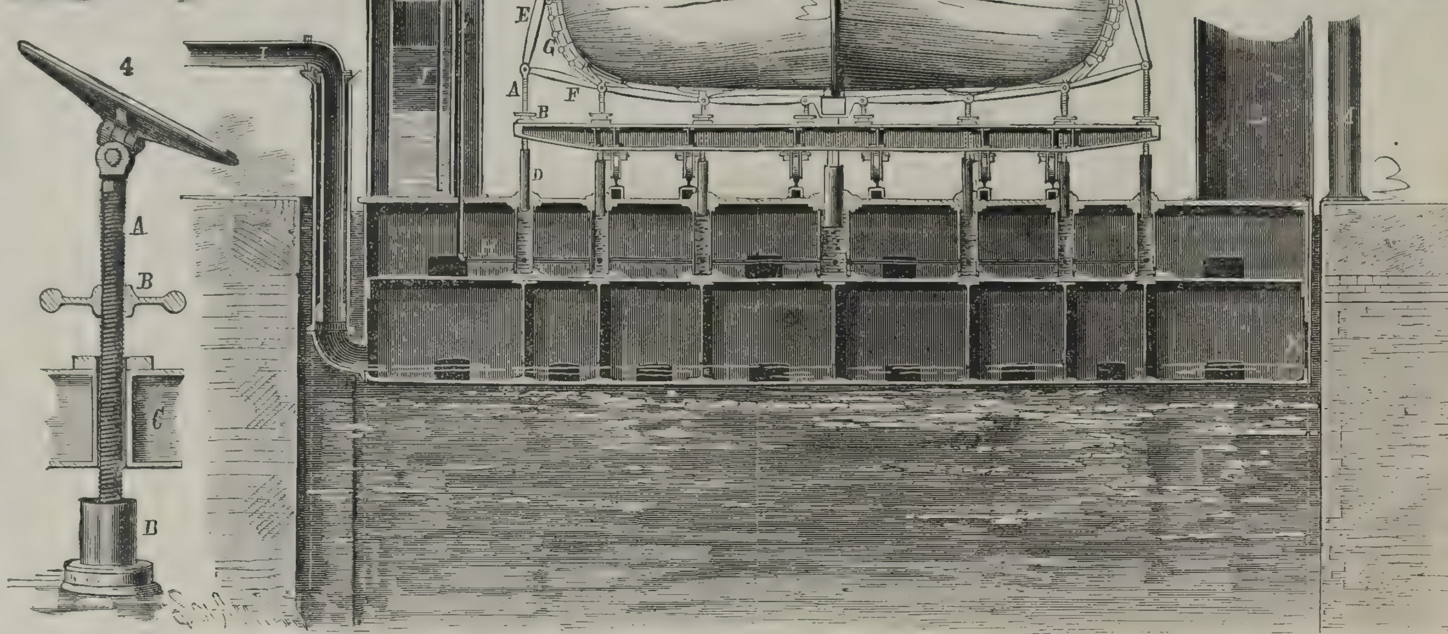
The Route *via* Tehuantepec is immeasurably superior to other projected lines, especially in its advantages to the United States and Mexico.

It is by far the shortest distance by water between our



Eastern and Western ports. It is a direct and necessary supplement to the Mississippi River and is virtually its commercial extension into the Pacific Ocean.

It is the best strategic location for the protection of the ship railway by Mexico and the United States as it can by the time it is completed be reached by railroad as well as by steamers from our Gulf ports.



THE INTEROCEANIC SHIP RAILWAY.—SECTIONAL ELEVATION OF PONTOON AND RAILWAY CRADLE.

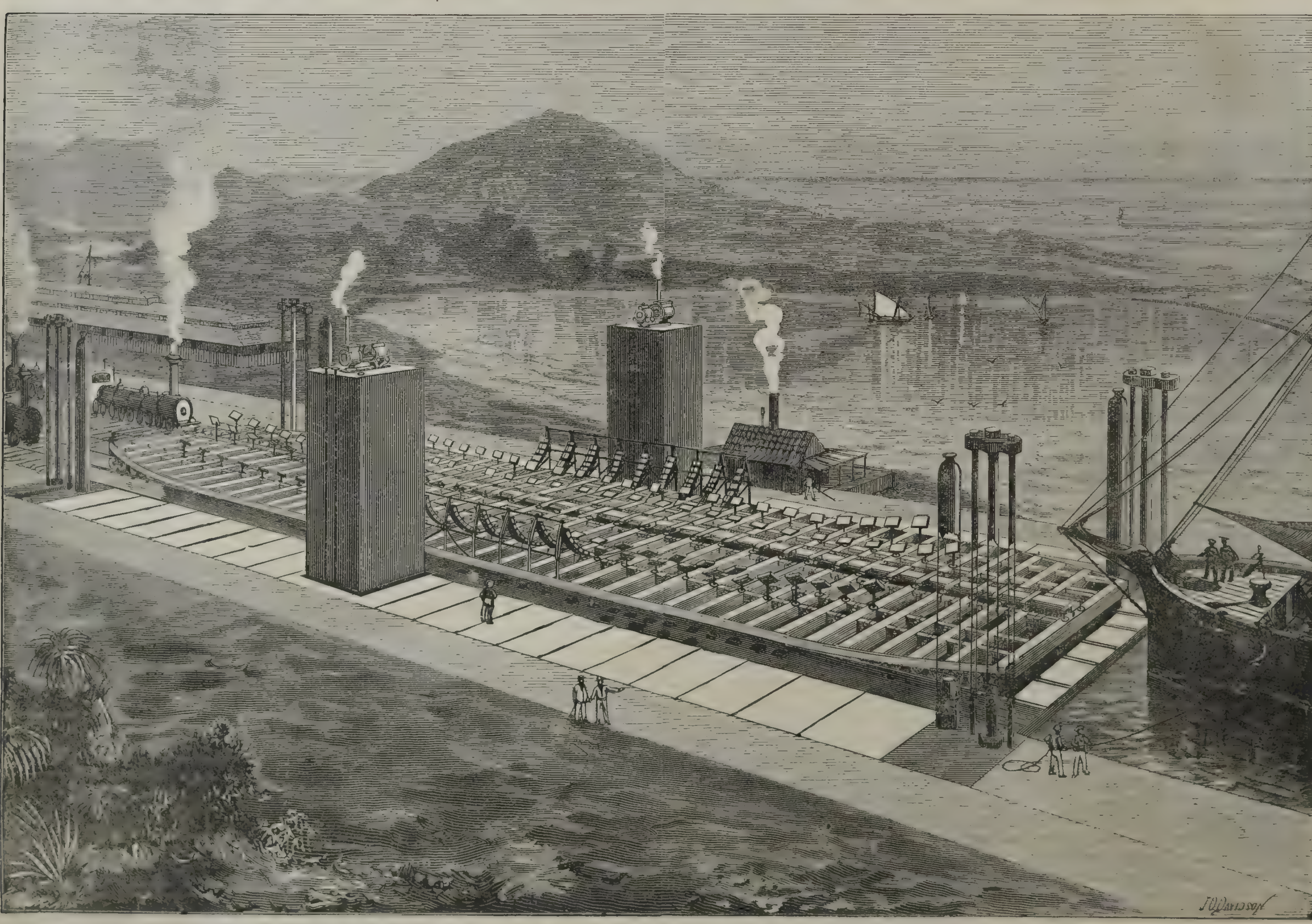
The promise of an original undertaking may be said to be directly as its author has succeeded or failed in previous enterprises, and hence it is but natural that the reader should like to know something about Mr. James B. Eads.

Mr. Eads designed and constructed fourteen ironclad steamers for the U. S. Navy in 1862 to 1864. On some of these from his designs the first heavy guns ever worked by steam machinery were used. These vessels enabled Foote, Davis, Porter, and Farragut to open the Mississippi and capture Mobile. During the seven years succeeding the war Mr. Eads was engaged in the design and construction of the magnificent steel arched bridge over the Mississippi, whose foundations are the deepest in the world, and whose three grand arches each exceed 500 feet span. This structure is pronounced by the British Encyclopædia the finest specimen of arch construction in the world.

Ten years ago the bars at the mouths of the Mississippi below New Orleans had approached so near the surface that it looked as though that great city would be open in the near future to nothing larger than sloop navigation. Two bills were introduced into Congress relating to this subject.

One from the headquarters of the Engineer Corps of the army advocated the construction of the Fort St. Philip Canal, leading from the river to the adjacent bay about forty miles above the mouth of the river. The second bill was presented by Mr. Jas. B. Eads, and contained a proposition for improving the mouth of the river by means of jetties. This met with strong opposition. Mr. E. L. Corthell's paper on "The South Pass Jetties," read before the American Society of Civil Engineers, says:

"The propositions enunciated by the Board of Army Engineers and by the Chief of Engineers, on which they based their published prophecies of failure, were:



THE INTEROCEANIC SHIP RAILWAY.—THE LIFTING PONTOON AND RAILWAY CRADLE.

"*First.*—That the jetties would be undermined at the sea ends.

"*Second.*—That the foundation on which they would rest was unstable. And

"*Third.*—That there would be a greatly accelerated advance of the bar after the jetties were constructed

"Three positive opinions were given in official reports by three prominent United States engineers—one the then Chief of Engineers, another the present Chief of Engineers, and the third the officer in charge of the improvement of the Gulf ports—in reference to the rapid and accelerated growth seaward of the bar in consequence of jetties, which would produce a depth of from 25 to 27 feet, if such could be constructed. These gentlemen respectively gave as the annual rate of advance, after the construction of jetties at the mouth of the South Pass, 670 feet, 2,240 feet, and (in the language of the third) 'jetties will have to be built further and further out, not annually, but steadily every day of each year, to keep pace with the advance of the river deposit into the Gulf, provided they are attempted.'"

Of this ponderous opinion Mr. Corthell remarks, with something very like sarcasm:

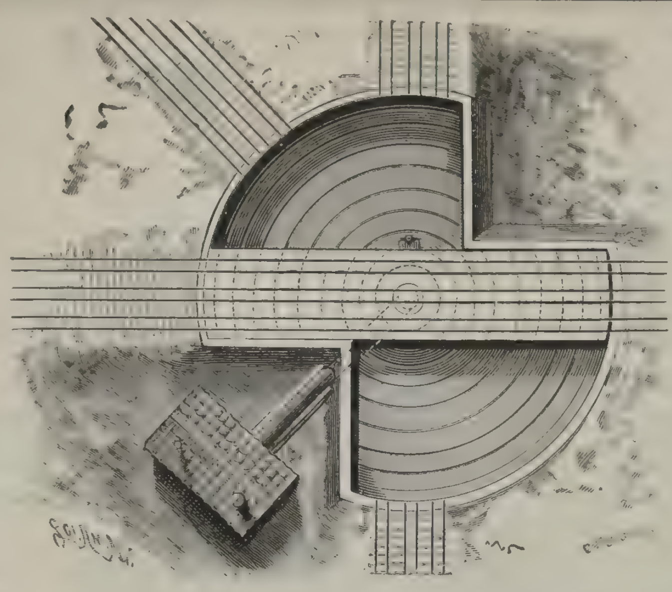
"The necessary extension of the jetties into the Gulf with these rates of bar advance would have been up to this date respectively three-quarters of a mile (to where there is now actually 160 feet depth of water), two and one-half miles, and well out toward Cuba."

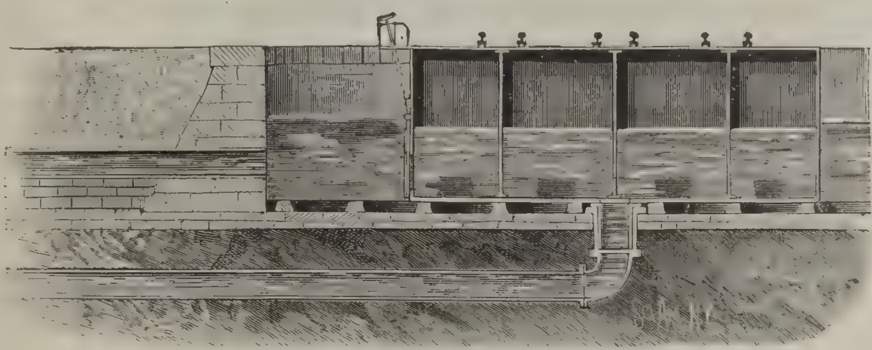
Mr. Eads finally succeeded in convincing Congress that there was at least something in his scheme, and he was given the contract, with the proviso that he should not be paid until he had secured the depths and widths of channel specified in the contract. From the very inception of his jetty system it was a remarkable success; the South Pass deepened more and more by the scour of the river, until upon its shoalest spot he had 30 feet of water—a depth it maintains to this day, when the Great Eastern, the largest ship in the world, is able to cross the spot where, ten years ago, there was only 9 feet of water. The fame of Mr. Eads, and his new interpretation of the Old World's jetty system, soon became an absorbing topic among hydrographers and engineers far and near. The Prince of Wales presented him with the Albert medal, which was awarded by the Society of Arts,

"To Captain James B. Eads, the distinguished American engineer, whose works have been of such great service in improving the water communications of North America, and have thereby rendered valuable aid to the commerce of the Old World."

Mr. Eads is the only American on whom this distinguished honor has been conferred. If his plans are not thwarted by impolitic government interference, there is reason to believe that ere long the graceful masts and trailing yards of majestic ships will be seen to mingle with tropic palms in the mountain fastnesses of the Cordilleras, on the ship railway.

In our illustrations, Fig. 1 shows an elevation of the adjusting of the screw standard for supporting the vessel on the pontoon, the detail of these standards being given in Fig. 4. A is the standard, having a head plate with universal joint, its top cushioned with rubber or canvas, to prevent damage to the ship; B is an adjusting nut, which, when the rams are down, stops the descent of the jack by contact with the top side of the main girder, C, on which they will rest, D being the top of the hydraulic jack of the pontoon, the number of these jacks used being better shown in Fig. 3, a perspective of the floating pontoon. E F G, in Fig. 2, show the sectional girders by which the weight of the vessel is distributed on the jacks. H shows one of the upper pontoon sections. J shows an arrangement in connection with the pump on pumping tower, L, to distribute the load of the vessel equally on all the jacks. I and K show the arrangement by which the water is exhausted from the pontoon. On each side of the basin there are several rods, on top of which are nuts capable of holding the pontoon, to prevent its rising above the level of the railway when the ship and cradle have been taken off. Figs. 5 and 6 show a plan and sectional view of the floating turntable, and Fig. 7 a perspective view, with a ship on the turntable.





Figs. 5 & 6.—ILLUSTRATIONS OF THE TURNTABLE.

IT is proposed to hold in London, in 1886, an American Exhibition, in which American manufacturers, merchants, and producers will be invited to show the products of American intustry of all kinds and descriptions. The intention is that the exhibition shall be opened on May 1, 1886.

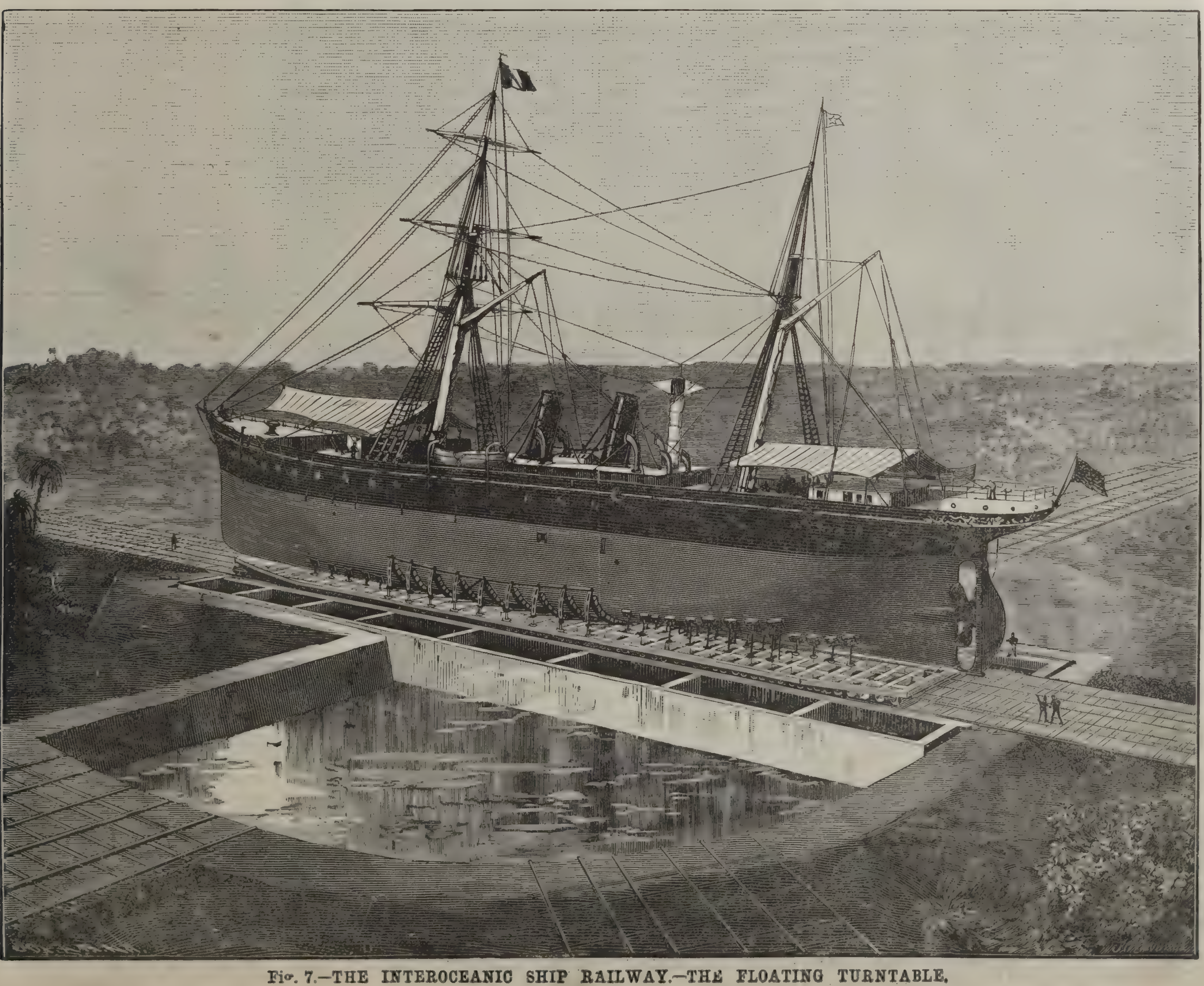


Fig. 7.—THE INTEROCEANIC SHIP RAILWAY.—THE FLOATING TURNTABLE.

OUR FIRST NUMBER.

The first number of the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN was issued November 1, 1885. Its contents are of much interest and value, as will be seen from the table given below.

It is accompanied by two supplements, consisting of two plates in colors, illustrating a country residence, by O. P. Hatfield, architect, and a large sheet of details pertaining to the same. The November number is further illustrated by fifty choice engravings.

TABLE OF CONTENTS

Of the November number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked *.)

OUR SECOND NUMBER.

With the December number we sent two large supplements, one of which comprises colored plates illustrating a beautiful and attractive country residence by Mr. John E. Baker, the well known architect of Newark, N. J. The other supplement consists of a large sheet of details of the same.

TABLE OF CONTENTS

Of the December number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked *.)

Responsibility for Cars.

Judge Samuel Treat, in the United States Circuit Court, lately delivered an interesting opinion in the case of the Missouri Pacific Railway Company against the Chicago & Alton Railway Company, which throws light upon the vexed question of ownership of and responsibility for cars given to another road in the regular course of railroad traffic. Said the court:

It appears that the course of through traffic among railroads requires each to receive cars owned by other than the transporting road, and forward the same; and accepting the general principle stated in 109 Illinois Reports, 135, that each road as to said cars by it so received and forwarded to the next road is under the obligations of a common carrier, the case before the court shows that there were 10 cars to be delivered to the Advance Elevator, and received by the defendant for that purpose. Six of these were actually delivered, and were in possession of said elevator. Four of said 10, still in actual possession of the defendant, had been tendered to said elevator and remained in the custody of the defendant from the inability of the elevator to receive the same when so tendered.

All of these cars were destroyed by fire without any fault of the defendant. As to the six cars actually delivered and so destroyed, there evidently can be no recovery. The duties of the defendants as to the other four of said cars were simply those of a warehouseman. When a common carrier transports merchandise and delivers the same to the consignee, its obligations with respect thereto are at an end. If, however, the same are tendered to him, and through no fault of the carrier he does not, or will not, receive the same, the carrier can cause the same to be stored at the risk of the consignee or retain possession of the same simply as a warehouseman. Were this not so, the through traffic from one part to the other of this vast country would compel not only the breaking up, but the stoppage of trains, if at the intermediate points of delivery the consignee failed or refused to receive consignments.

In this case, if we treat the transportation of cars as if merchandise to be received and delivered to the consignee, it appears that these cars, with their contents, were to be delivered loaded with grain to the elevator. If both the cars and their contents are to be covered by the same rule, then the delivery of the cars with their contents terminates the obligations of the defendant.

The court is not prepared to say that where a railroad car, in the course of through transportation, is received to be delivered to another railroad, and has been so delivered, it is bound to cause the same to be returned either to the owner of the car or to the railroad from which the same was originally received; nor that it is under all circumstances entitled to recover in its own name from what may subsequently happen with respect thereto. In this case, as already stated, there can be no recovery as to the ten cars shipped to the Advance Elevator.

Two other cars were delivered to the defendant to be sent by it eastward, which were destroyed by the fire alluded to, the value of said cars being $602, $100 of the wrecked material having been received by the plaintiff. As to said two cars, the obligations of a common carrier existed, consequently the defendant is liable for the sum of $502, for which judgment is ordered.—*St. Louis Rep., Nov. 7.*

Marking Ink.

REIMANN gives the following recipe for a marking ink: 1·1 pts. nitrate of silver, 2·3 pts. spirit of ammonia, 2·2 pts. soda, 5 pts. gum arabic, 0·2 pt. sap-green, 2 or 3 pts. distilled water. After marking apply a hot flat-iron until the tracing is perfectly black.

A SUBMARINE TORPEDO BOAT.

The accompanying engravings represent a submarine torpedo boat, designed by Mr. J. L. Tuck, and built at the De Lamater Iron Works, this city. The boat is 30 feet long over all, 7½ feet broad, and 6 feet deep. The side frames are carried up and arched over the top to form the rounded deck, which completely covers the hold, except at the round hatch in the center. At this hatch is a well, provided with a door on one side leading into the hold. Placed at each side of the keel is enough lead to load the boat to the water's edge; and to sink the vessel below the surface there are several small compartments, which can be filled with water and emptied as required. Over these compartments, on each side and beneath the floor, are a number of 6 inch iron pipes, which can be filled with compressed air, to be liberated as the air within the boat grows foul. The propeller is turned by an ordinary dynamo run by storage batteries, which also furnish electricity for the incandescent lamps lighting the interior. A common rudder steers the boat to starboard or port, while a horizontal rudder, centrally hinged in a frame at each side of the stern, will elevate or depress the stern, and thereby guide the vessel further from or nearer to the surface, independent of the action of the water ballast pump.

Fig 1.—THE TORPEDO LEAVING THE VESSEL.

The well hole in the center of the deck is fitted with an air tight hatch, which can be removed from within. The individual wishing to go on deck when the boat is submerged dons an ordinary diver's suit, the air pipes of which connect with the interior, enters the well, closes the door behind him, and after the well has filled with water removes the hatch. In the well are suitable devices for directing those inside for elevating, lowering, and propelling the boat. When leaving the well, the hatch is closed and the water allowed to run into the water ballast compartments, when the door leading to the interior can be opened.

When used in warfare, it is designed to sink the torpedo boat to the proper depth, approach the vessel to be destroyed, and, as the torpedo passes beneath her, release a strong insulated wire carrying two cartridges—one at each end—filled with some powerful explosive and lightened with cork, so that they will rise against the bottom of the vessel. The torpedo is then run ahead to a safe distance, when the cartridges are exploded by electricity, through wires leading from the boat to the cartridges. Just astern of the hatch is a cupola, having glass windows. In the engravings, Fig. 2 shows the torpedo approaching the vessel, and Fig. 1 shows the torpedo passing away, the cartridges having been released. Fig. 3 is an enlarged view of the torpedo directly beneath the vessel.

Fig. 3.—THE TORPEDO DIRECTLY BENEATH THE VESSEL.

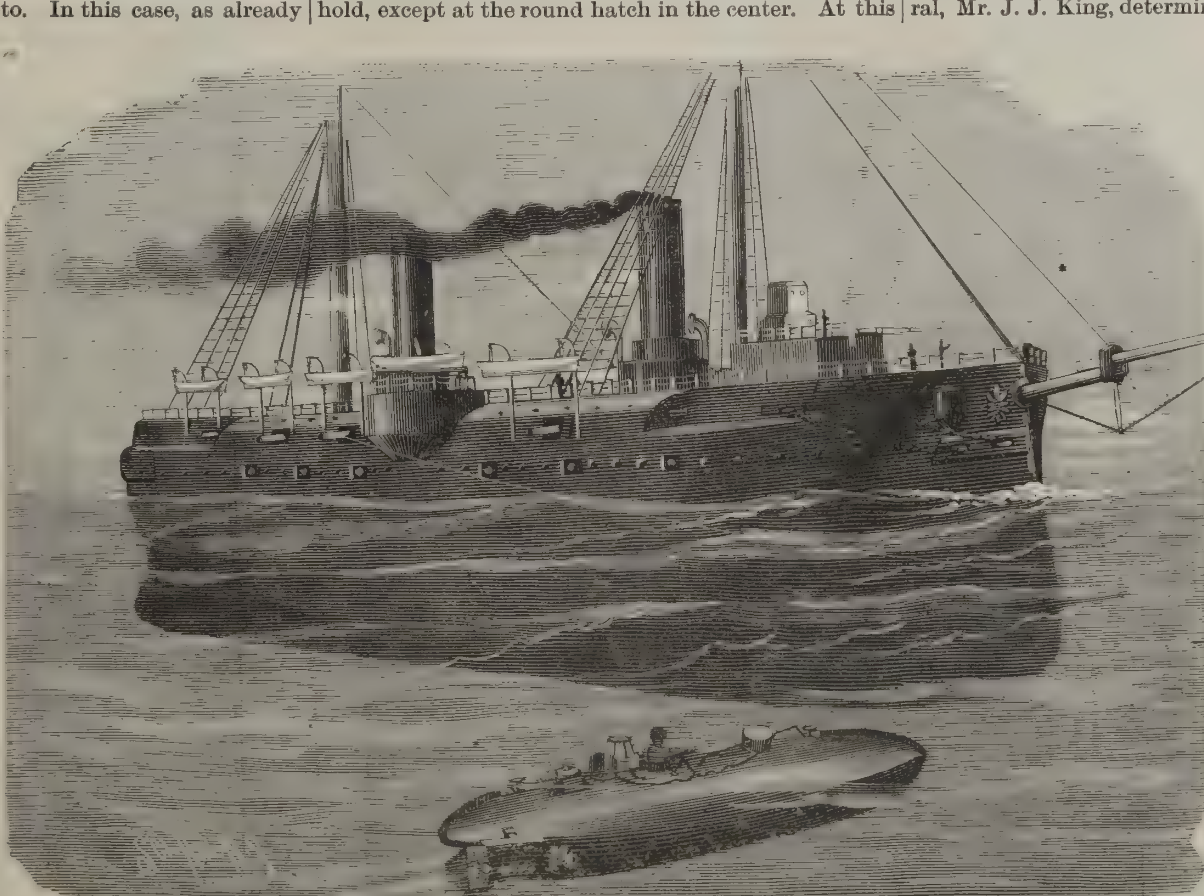


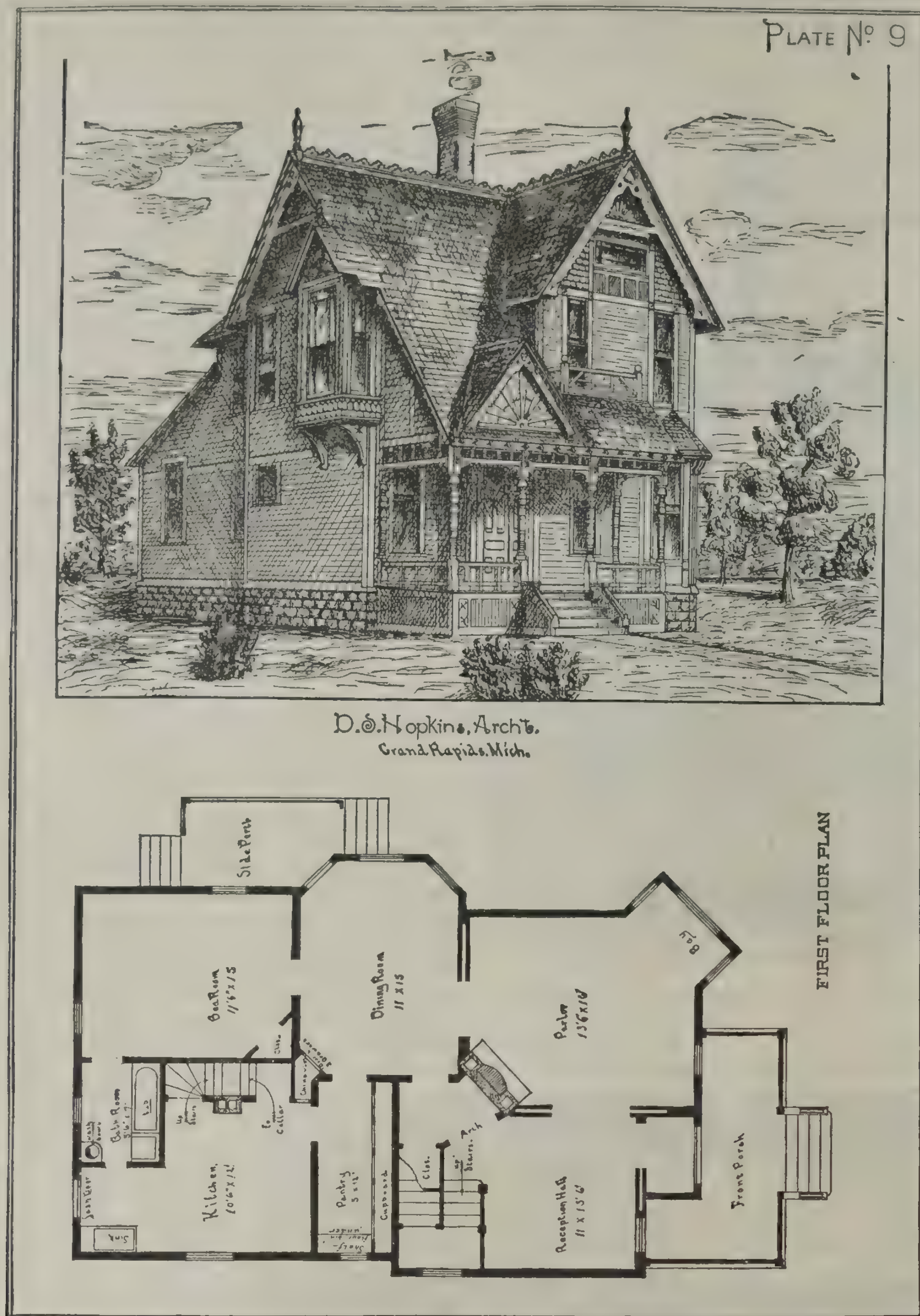
Fig. 2.—A SUBMARINE TORPEDO BOAT—THE TORPEDO APPROACHING THE VESSEL.

A Large Garnet.

While making the excavations for a sewer on 35th St. between 7th Ave. and Broadway, New York city, the workmen recently uncovered a large garnet which was inclosed in the gneiss about nine feet below the level of the street. The crystal was a well defined trapezohedron, having its angles truncated and beveled by the rhombic dodecahedron and the hexakisoctahedron, a combination quite characteristic of the garnet. The crystal had been a little mutilated by the workmen, but all of the upper octons were very well developed, and the lower ones for about half their distance. The owner of the mineral, Mr. J. J. King, determined its total weight, including a little quartz and serpentine attached to the lower portions, to be nine and a half pounds. The horizontal axes were six inches. The exterior of the crystal was slightly weathered, but a fresh fracture showed a fine red color.

Display of Meteors.

A grand display of meteors was witnessed by Mr. P. Benson, at Ishpeming, Mich., on the evening of Nov. 27th. They appeared, he says, with few exceptions, to radiate from a region bounded by the constellations Aries, Andromeda, Pegasus, Lyra Corona, Borealis, and Ursa Major. Between six and seven o'clock Mr. Benson counted as many as thirty in five minutes. The appearance of many of them was very striking, and all seemed moving in a westerly direction.



A $2,000 HOUSE.

A $2,000 HOUSE.

We give plans and elevations of a Western cottage designed by D. S. Hopkins, architect, Grand Rapids, Mich.

"The plan," he says, "is one that generally pleases the people of this section, and is admirably adapted to their wants. I built this house during the past season for a speculator, under contract for $1,740, without plumbing. I call it a $2,000 house, however, as the contractor says it cannot be built for much less. It is of a semi-colonial style—not so much so, perhaps, as some of the houses East, but I think more pleasing, and certainly more adapted to the climate of this State."—*Builder and Wood-Worker.*

CHEAP HOUSES.

Figure 1 represents a design for a commodious country dwelling. But little attempt has been made at ornamentation, the object being to present a showy house at as little cost as possible. The windows being placed in the corners is an innovation on the present popular style of bay windows, and is certainly much less expensive. This building can be erected for from $4,500 to $6,000, depending altogether upon the styles and character of finishes used.

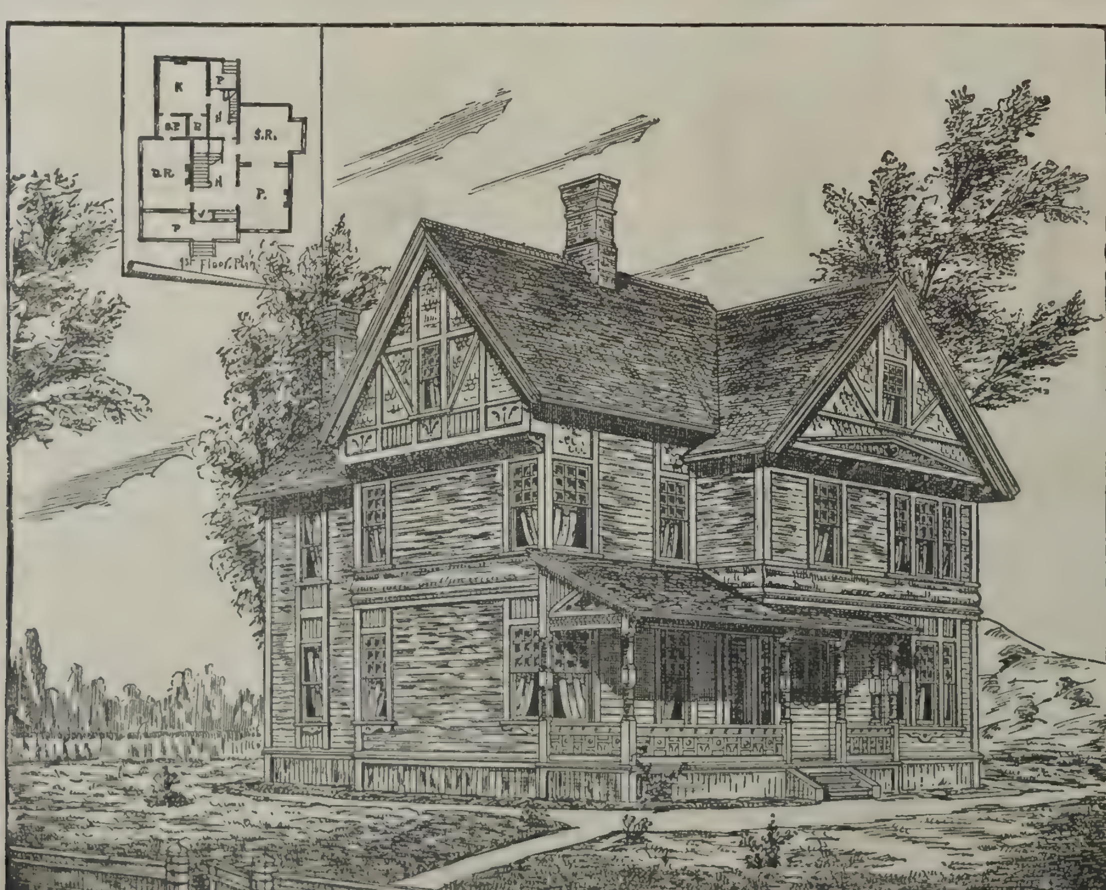


Fig. 1.—DESIGN FOR A COUNTRY DWELLING COSTING $4,500 TO $6,000.

Fig. 2.—FRONT ELEVATION OF DWELLING COSTING ABOUT $3,500.

Figures 2, 3, and 4 show the plan, front and side elevations of a beautiful country dwelling, costing about $3,500. This sum can be varied greatly, as almost double that amount could be used to advantage if extra nice finishes are employed. The amount quoted allows for as nice finish on the outside as is shown by the engraving, and neat finishes inside. The arrangement of the rooms is such as to especially recommend the plan for a country dwelling. Stairs are shown leading to the attic. If desired, the elevation could be made 2½ feet higher than shown, and the design thus changed into a 1½ story house. It will be noticed that the arrangement of the hall is such that in summer a perfect system of ventilation can be had, and in winter, by the use of the hall and other fireplaces, the home can be agreeably warmed in every part.—*Cal. Architect.*

Fig. 3.—SIDE ELEVATION OF DWELLING COSTING ABOUT $3,500.

Fig. 4.—PLAN OF COUNTRY DWELLING COSTING $3,500.

PAINT sticks to tin that has been exposed to the weather for a short time better than to fresh, bright tin. There is a slight film of oxide formed by the exposure, which prevents the paint from chipping off.

HOTEL DE VILLE, ST. QUENTIN.

THIS charming building has an uncommonly well-designed facade, picturesque in the extreme, rich in detail, and thoroughly dignified. We are indebted to M. Levy, of Paris, for the loan of M. Garen's spirited etching, from which our illustration is taken. The arcaded piazza on the ground story, the niche-spaced tier of traceried windows on the first floor, the flamboyant paneled cornice stage, and the three crowning gables over it unite in one harmonious conception, the whole elevation being finished by a central tower, while at either end of the facade two massively treated buttresses furnish a satisfactory inclosing line, and give more than a suggestion of massiveness, so necessary to render an arcaded front like this quite complete within itself; otherwise it must more or less appear to be only part of a larger building. The style is Late Gothic, designed when the first influence of the Early Renaissance was beginning to be felt through France as well as Belgium, and in several respects the design has a Flemish character about it.

St. Quentin is situated on the Goy, in the department of Cotes du Nord, and the town is seated in a picturesque valley some ten miles S.S.W. of the capital, St. Brieuc, which is a bishop's see, and has a small harbor near the English Channel, and about thirty miles from St. Malo. —*Building News.*

HOTEL DE VILLE, ST. QUENTIN.

FIRE DOORS IN MILLS.*

THERE are few parts in fire construction which are of so much importance, and generally so little understood, as fire doors. Instances of the faulty construction of these, even by good builders and architects, may daily be seen. Iron doors over wooden sills, with the flooring boards extending through from one building to the other, are common occurrences. We frequently find otherwise good doors hung on wooden jambs by ordinary screws. Sliding doors are frequently hung on to woodwork, and all attachments are frequently so arranged that they would be in a very short time destroyed by fire, and cause the door to fall. In case of fire, a solid iron door offers no resistance to warping. In an iron lined door, on the contrary, the tendency of the sheet iron to warp is resisted by the interior wood, and when this burns into charcoal, it still resists all warping tendencies. I have seen heavily braced solid iron doors warped and turned after a fire, having proved themselves utterly worthless. It is needless to say that when wooden doors are lined, they should be lined on both sides; but frequently we find so-called fireproof doors lined on one side only.

Good doors are frequently blocked up with stock and other material, so that in case of fire they could not be closed without great exertion; or they have been allowed to get out of order, so that in case of fire they are useless. This has been so common that it has given rise to the jocular expression of insurance men, when they are told that a fire door exists between the two buildings, "Warranted to be open in case of fire." The strictest regulations should exist in regard to closing the fire doors nightly. Frequently we find that although the fire door, and its different parts, are correctly made, there are openings in the wall which would allow the fire to travel from one building to the other, such as unprotected belt and shaft holes. That a fire door may be effective, it must be hung to the only opening in the wall.

The greatest care must be exercised to keep joists from extending too far into the wall, so as not to touch the joists of the adjacent building, which would transmit the flames from one building to the other in case of fire. A good stone sill should be placed under the door, and the floor thereby entirely cut. Sills should be raised about one and a half inches above the level of the floor, in order to accomplish the necessary flooding of the same. If stock must be wheeled from one building to the other, the sill can be readily beveled on both sides of the wall, allowing the wheels to pass readily over it. Lintels should consist of good brick arches. When swing doors are used, they should be hung on good iron staples, well walled into the masonry, and the staples so arranged that the door will have a tendency to close by its own weight. The door should consist of two layers of good one and a quarter inch boards, nailed crosswise, well nailed together and braced, and then covered with sheet iron nailed on, or if of sheet tin, flanged, soldered, and nailed. Particular care should be taken to insert plenty of nails, not only along the edge of the door, but crosswise in all directions. I have seen cases, where the entire covering had been ripped off through the warping tendencies of the sheet iron.

The hinges on these doors should be good strap hinges, tightly fastened to the door by bolts extending through it, and secured by nuts on the other side. Good latches which keep the door in position when closed should always be provided. In no case should the door be provided with a spring lock which cannot be freely opened, as employes might thereby be confined in a burning room.

Sliding doors should be hung on wrought iron runways, fastened tightly to the wall. Wooden runways iron lined, which we frequently see, are not good, as the charring of the wood in the interior causes them to weaken and the doors to drop. Runways should be on an incline, so that the door when not held open will close itself. Care must be taken to have a stop provided in the runway, so that the doors may not, as I have frequently seen them, overrun the opening which it is to protect. Doors should overlap the edges of the openings on all sides. Large projecting jambs should never be used.

All doors contained in "fire walls" should have springs or weights attached to them, so as to be at all times closed. Fire doors can be shut automatically by a weight, which is released by the melting of a piece of very fusible solder employed for this purpose. So sensitive is this solder that a fire door has been made to shut by holding a lamp some distance beneath the soldered link and holding an open handkerchief between the lamp and link. Though the handkerchief was not charred, hot air enough had reached the metal to fuse the solder and allow the apparatus to start into operation.

These solders are alloys more fusible than the most fusible of their component metals. A few of them are: Wood's alloy, consisting of: cadmium, 1 to 2 parts; tin, 2 parts; lead, 4 parts; bismuth, 7 to 8 parts.

This alloy is fusible between 150° and 159° Fahr. The fusible metal of D'Arcet is composed of: bismuth, 8 parts; lead, 5 parts; tin, 3 parts.

It melts at 173·3°. We can, therefore, by proper mixture, form a solder which will melt at any desirable temperature. Numerous devices for closing doors automatically have been constructed, all depending upon the use of the fusible solder catch.

* From a lecture before the Franklin Institute by C. John Hexamer.

STEEL STRUCTURES.

AT a recent meeting of the Engineers' Club of Philadelphia, Mr. James Christie presented a paper upon "The Adaptation of Steel to Structural Work." The price of steel has now fallen so low, as compared with iron, that its increased use will be actively stimulated as the building industries revive. The grades and properties of the steels are so distinct and various that opinions differ much as to the adaptability of each grade for a special purpose. Hitherto, engineers have favored open hearth steel on account of uniformity, but recent results obtained from Bessemer steel tend to place either make on equality. The seeming tendency is to specify what the physical properties shall be, and not how the steel shall be made.

For boiler and ship plates, the mildest and most ductile steel is favored. For ships' frames and beams, a harder steel, up to 75,000 pounds tenacity, is frequently used. For tension members of bridges, steel of 65,000 to 75,000 pounds tenacity is usually specified; and for compression members, 80,000 to 90,000 pounds. In the Forth Bridge, compression steel is limited to 75,000 to 82,000 pounds. Such a marked advantage occurs from the use of high tension steel in compression members, and the danger of sudden failure of a properly made strut is so little, that future practice will favor the use of hard steel in compression, unless the material should prove untrustworthy. In columns, even as long as forty diameters, steel of 90,000 pounds tenacity will exceed the mildest steel 35 per cent, or iron 50 per cent., in compressive resistance.

The present uncertainty consists largely as to how high-tension steel will endure the manipulation usual with iron without injury. A few experiments were recently made by the writer on riveted struts of both mild and hard steel, which had been punched, straightened, and riveted, as usual with iron, but no indication of deterioration was found.

Steel castings are now made entirely trustworthy for tensile working stresses of 10,000 to 15,000 pounds per square inch. In some portable machinery, an intermittent tensile stress is applied of 15,000 pounds, sometimes rising to 20,000 pounds per square inch of section, without any evidence of weakness.

EQUAL volumes of amyl alcohol (rectified fusel oil) and pure concentrated hydrochloric acid, shaken together in a test tube, unite to form a single colorless liquid; if one volume of benzine (from petroleum) be added to this, and the tube well shaken, the contents will soon separate into *three* distinct colorless fluids, the planes of demarkation being clearly discernible by transmitted light. Drop into the tube a particle of "acid magenta;" after again shaking the liquids together, the lower two zones will present different shades of red, while the supernatant hydrocarbon will remain without color.

ROYAL ACADEMY TRAVELING STUDENTSHIP DESIGN FOR BLOCK OF THREE HOUSES.

This is a perspective drawing, exhibited in this year's Academy, of the design by Mr. Frederick M. Simpson, that gained the R.A. Traveling Studentship in 1884.—*Building News.*

NEW YORK LAUNDRIES.

Although thousands of small laundries exist, some managed by the robust daughters of the Emerald Isle, some by dusky maidens, and the rest by Celestials, the big laundries get the big bundles of soiled linen. Like everything else, washing and ironing have developed into a business of considerable size and importance. Says a writer in the *N. Y. Times*: The washerwoman nowadays has to compete with machinery and steam power. The washtub becomes a huge revolving drum, the wringing machine a centrifugal drier, the clothes line in the back yard a frame in a drying box, and the flat-iron an iron roller six feet in length. In buildings rising story upon story, an entire floor is devoted to each branch of the work. The bundles are gathered by covered wagons, and hundreds of women and girls are employed in the various branches. A day's stock of linen in a big hotel can be washed, dried, and ironed in six hours. Every week day is wash day in a big laundry, and in the middle of the summer season work is carried on during half of Sunday. In a big laundry on the West side of town, the manager's office is as comfortable and neatly furnished as that of a wholesale dry goods merchant. The manager is a man of business, having dealings with hotel proprietors and the agents of steamship and steamboat lines and palace car companies. The plant cost more than $100,000, and the concern is under the control of a stock company. It has facilities for turning out 75,000 pieces of linen in a day. In the busy season an ocean steamship will send 15,000 pieces to be done in a day. The company has built a tall, deep, well-lighted and well ventilated building of brick with stone trimmings. One 100 horse-power engine and two 200 horse power boilers furnish the power and the steam and hot water.

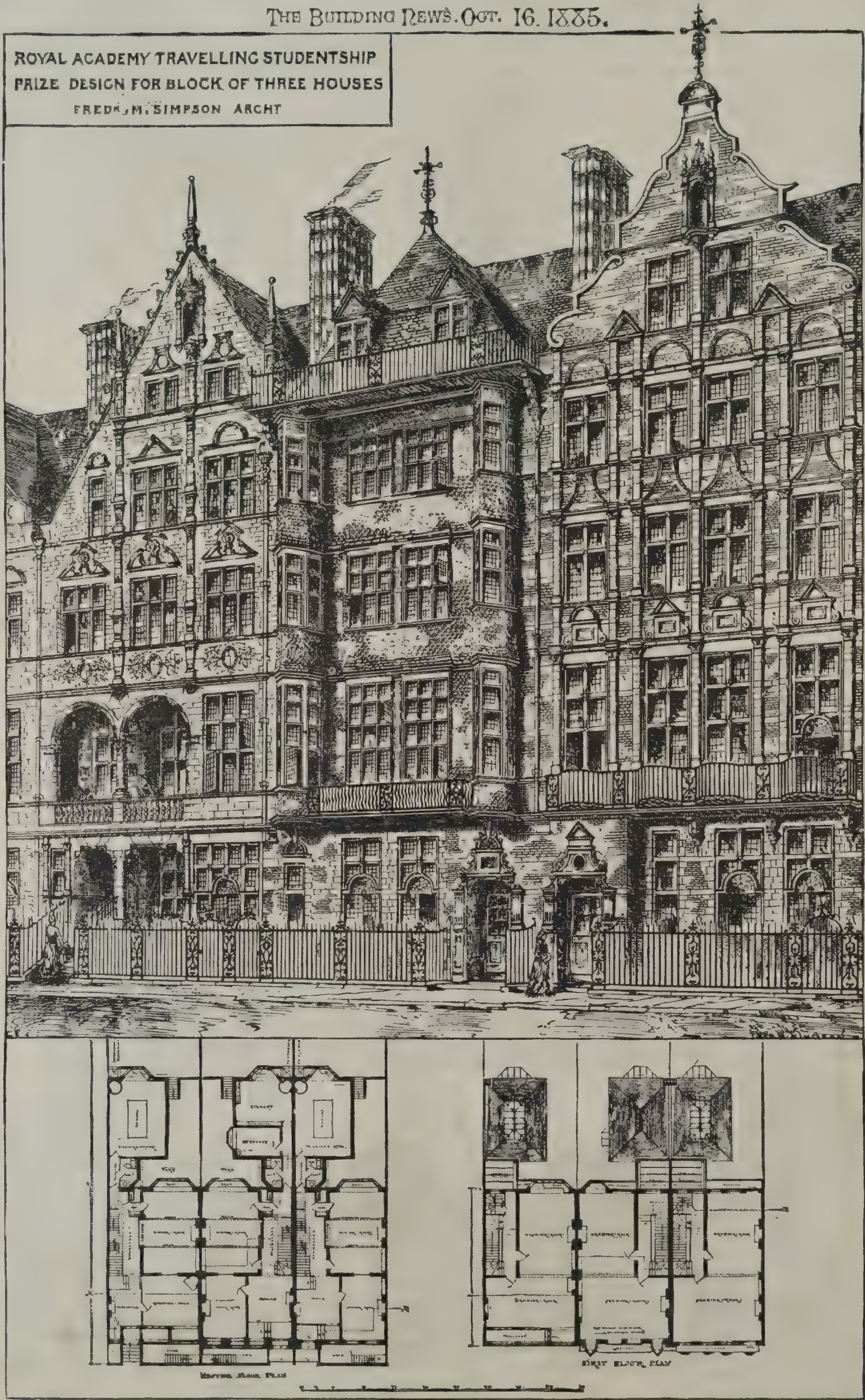
"A laundry is the poorest place in the world to show the use of money," the manager remarked in the course of a general talk about the business. "More than $100,000 in hard money has been spent in this laundry; but if I should take a business man through here and tell him what it cost, he would not believe me. The cost of the steam pipes that are out of sight in boxes was immense, and wood was not a small item. We must have the best of dried lumber for the drying boxes. Then come the washing machines and ironing machines. Of course, we are not working up to our limit all the time, but we must be ready for a rush any day in summer. We do the work of city hotels, ocean steamships, river and sound steamboats, and the Pullman Palace Car Company. Our biggest job lately was the linen of the sleeping cars that took to and brought from Washington the inauguration crowd. With trains going out every two hours, we had to be lively in order to furnish a stock of clean linen. Besides using our own wagons, we had to hire wagons to collect and deliver the bundles. We do a little piece work, but we don't cater to that trade. We have, perhaps, forty or fifty customers in this neighborhood, but the work for them does not amount to much. This is a separate branch of the business.

"Doing up new linen is another distinct branch of the business, and we do nothing with that. Some laundries do that and nothing more, and they have built up a fine business with furnishing houses. There are other big laundries that have only piece work. They get the collars, cuffs, and shirts supposed by many persons to be sent to Troy. The Troy laundry that you see on the signboards of furnishing and some dry goods stores is really in New York. Years ago, collars and cuffs were sent to Troy. Several large manufacturers of collars and cuffs are there; and when it used to cost seventy-five cents a dozen to have collars and cuffs washed and ironed here, they got the work because they could do it cheaper. But that work is done here now. The furnisher, while admitting that the work is done here, will tell you that it is the Troy finish that you will get. You will find the so-called Troy laundries wherever you go. I was down in Massachusetts a while ago, and saw a furnisher who advertised as the agent of a Troy laundry. I saw the card on one bundle, and it was that of a New York laundry. It is a big branch of the business, and can be carried on here just as well as in Troy. Machinery has cheapened the cost. Come into the wash room."

In the rear of the office, half the floor was given to the receiving and delivering of bundles, and the rest to washing machines. On the floor were piles of dirty linen, some comparatively clean and others offensively dirty. They were collected in big canvas bags marked with the name of the hotel or steamship. The linen is assorted and piled according to the degree of uncleanliness. The dirtiest piles come from the kitchens. Each collection is washed, dried, and ironed separately, and each assortment is washed separately, a special washing machine taking the dirtiest. Along the sides of the room were big wooden iron-strapped drums reaching nearly to the ceiling, with lines of iron pipes on top and underneath. In the middle of the room were several smaller washing machines, and back of them were three centrifugal driers revolving at the rate of 800 times a minute. In the big drums are two revolving cylinders with arms that work in opposite directions. Soap is bought in casks by the hundred pounds, and when ready for use is melted and in a condition to be immediately taken up by the water. Through openings in the big drums pieces of linen are thrown as a farmer throws hay. One set of arms catches them and throws them about. When they fall, another set catches them and shakes them. About 150 sheets or 1,200 napkins and towels can be washed in each drum. For the dirtiest linen special soap and sal soda are used. The pieces tumble about, and the dirt falls out and is carried away through pipes. In the smaller washing machines the pieces are thrown into a cylinder of perforated iron that turns a few times one way and then reverses. The revolutions must be at a certain speed to insure thorough washing.

When washed, the pieces are packed in the upright centrifugal drying machines, from the sides to the axle. When the machines are in motion, the water flies out and the clothes gradually shrink away from the center and pack themselves solidly against the sides. The machines can run up to 1,600 revolutions a minute, but it is not considered necessary. The pieces are not thoroughly dried in the machines, but sufficiently so to be handled. They are sent up in elevators to the drying boxes. The floor of the wash room is as wet as the deck of a ship, and the planks have to be laid and calked like those of a ship. In the stories above are fifteen ironing machines, with rollers from five to six feet in length heated by steam and gas. In the drying boxes the heat is so great that pieces of linen are dried in eight minutes. The pieces are put on long frames that are run through the boxes, and by the time one end of a frame is reached the pieces on the other end are ready to be taken off.

"Concussion does the washing," the manager explained. "There must be some fall to clothes to knock the dirt out. It cannot be thrown out by centrifugal force, and it cannot be beaten out. The constant tumbling about is the only sure method. We have tried all kinds of washing machines, but we find those of our own make the best. We invented the ironing machines we use, and sheets that used to be ironed in the old fashioned way may now be ironed by machinery. In takes four girls to iron a sheet—two to put the corners between the rollers and two to take the sheet out. It is cheap labor, however, and is done by girls fourteen or fifteen years of age. Ironing is the longest part of the work, because each piece has to be handled separately. Collars, cuffs, and all plain pieces are ironed by machinery, but shirts are ironed by hand. There are some men who iron shirts, but most of them are graduates of State prison. It is easy enough to keep track of all the pieces by having a system. We give an entire floor to the work for the Pullman Company, and by making a separate job of each lot that comes in from a hotel or steamship we know where we stand. We charge so much a hundred pieces for a big lot, and every bundle that comes in this morning goes out to-morrow morning. In a rush we can take in a lot at 10 o'clock in the morning, and have it ready to send out at 4 o'clock in the afternoon. The pieces from an ocean steamship will vary from 300 to 15,000, and those from hotels run up to 2,500 a day. When travel is large the bundles are large, and they must be done in a hurry. Guests' linen is washed and ironed separately, like the rest of our piece work. Some hotels do the guests' washing, but the others send out the bundles with the house linen. For piece work each piece is numbered with indelible ink, and after going through the machines is put into a compartment corresponding in number to that piece. It is a good deal like sorting letters in a post office."



NATURAL GAS.

Mr. S. Speeckly, of Cool Hill, Venango Co., Pa., sends us an account of three wells on his farm, which are the largest ever found in Venango Co. They average a depth of 1,950 feet, and showed an open test pressure respectively of 70, 125, and 130 pounds per square inch. Gas from the first two wells is allowed to escape through an 18 foot length of 2 in. tubing, and shows inclosed pressures of 500 and 600 pounds. It is thought that the inclosed pressure in the third well would amount to 800 or 1,000 pounds, but the pressure was too great to permit the well to be packed. It supplies most of the gas consumed for domestic and manufacturing purposes in Oil City, Franklin, and Titusville.

FARM BUILDINGS.

THE buildings shown in our illustrations have been erected within the last few months upon farms belonging to Lady Ogle, of Withdeane Court, Sussex, Eng. At Tongdeane Farm the new buildings, in addition to the cottages shown in the view, comprise cart sheds, root houses, stock yard and a cowhouse for sixty cows, with all the latest improvements in the drainage and water supply, each cow having a separate water tap, and the water being obtained from the corporation reservoirs at Brighton.

The buildings at Tongdeane and Varndeane were erected by Mr. James Barnes, of Brighton, and the whole of the works were designed by Lady Ogle's architects, Messrs. Charles E. Clayton and Ernest Black, of Brighton.—*The Builder.*

THE PRESENT CONDITION OF THE YELLOWSTONE NATIONAL PARK.

By E. D. COPE.

TIME has fully justified the enterprise of Dr. Hayden in urging upon Congress the project of the creation of the Yellowstone National Park; and the protection of this and other especially interesting parts of our country by the arm of the National Government has met with almost unanimous approval.

The function of the Yellowstone Park may be looked on as three-fold: first, as a place of permanent preservation of the geysers and hot springs and their deposits; second, as a place of protection of the game of the country; and third, as a place of recreation for tourists. The first of these uses has always been uppermost. The second has been more and more engaging the attention of Congress, and the *Naturalist* published an editorial in its issue of July, 1884, pressing on public attention the necessity of making it a more complete preserve for game than it had previously been. This article was reprinted; and later, our contemporary *Science* took up the subject editorially. As a probable consequence of this agitation, a bill was introduced into Congress, last winter, providing for a more complete supervision of the territory of the park. Ten men with a gamekeeper and the superintendent constitute the present force. As this was manifestly insufficient to police a territory of such great extent, the new bill contemplated the addition of fifteen men to the number, thus increasing the police to twenty-five men. Their salaries were fixed by the new bill at $1,500 per annum. The sum now paid is $900, from which the men are expected to feed themselves, an important consideration in so expensive a region. This bill was not passed.

Since the attention of Congress and of the press has been directed to the park, the protection of its beauties and curiosities has been more efficient. A number of persons have been fined for breaking the geyser deposits, including at least one member of Congress. In this respect the protection may be considered to be now fairly good. Protection of game has been less successful because more difficult, and because of the great inadequacy of the force. Bison, elk, moose, deer, etc., are far less abundant than when the park was first created. The bison have been, I am informed, reduced to a herd of about sixty individuals, and the elk have been decimated. The moose are confined to a small region. From the inaccessible nature of their habitat, mountain sheep have not been so reduced in numbers. Protection has, however, become more definite in this direction. During the past year several persons have been fined from $75 to $100, and one old hunter, who defied the guards, was caught, fined $100, and imprisoned for six months.

These measures of protection can, however, only be carried into effect by an increase in the force and their proper distribution throughout the territory. Persons may now hunt undetected in the park, and may drive game outside of its boundaries without difficulty and kill it. The disposition to kill is not controlled by any considerations of decency in some men. Thus a party of English shooters killed, for their amusement, twenty or thirty from the bison herd without taking any part of the animals for their use, thus reducing their numbers by one-fourth at least, at one battue. Some persons state that protection is useless because the game leaves the park in winter. This I ascertained is not true, for there are numerous well-protected localities where the game winter safely.

The bill which was brought before Congress last winter for the more efficient protection of the park should be passed by the Congress of 1885–86, with some possible amendments. Thus the force should be increased to twenty-five men, each with a salary of $1,000 per annum exclusive of his food and boarding. The park should be divided into twenty-five parts, each one supervised by one of the guards, with perhaps an assistant or roustabout. A simple house for the guard should be erected in each one of the divisions, and the guard should reside there through both winter and summer, and not be permitted, as is now the case, to come into the settlements and remain there during the winter. It is well known that large game may be more readily destroyed in winter than in summer. Those guards whose districts include the geysers will naturally be more occupied with the protection of these objects than with the protection of the game, as the one is generally abundant inversely to the other. Visitors should not be permitted to carry guns or other hunting apparatus through the park, and should be required to deposit them with some designated person to be held during their stay in it.

A project for reducing the size of the park has already been introduced into Congress. This is in order to permit the construction of a railroad to the Clark's Fork mining camp, through the park via the Yellowstone, the East Fork, and Soda Butte creek. As the law creating the park forbids the passage of railroads through it, it is sought to alienate a tract of land from the park, of a triangular shape, of about forty miles in length and twelve to fifteen miles wide at the widest part. An examination of the map will show that the direct route from the Clark's Fork mines to the Northern Pacific Railroad is not more than *one-tenth* as long as the one proposed to pass through the park, so that it is difficult to guess at the motive which prompts the proposition in view. The project should be subjected to the most rigid examination, as any alienation of the territory of the park seems to be unnecessary. On the other hand, much greater security as a game preserve would be accomplished if the region on the southeast border of the park, which includes the Hoodoo Mountains, were annexed to it. It is the headquarters of the game of the country, and that of the park frequently resorts to it. It is excessively rugged, and is nearly useless to man for any other purpose.

As regards the entertainment of tourists, the administration of the new superintendent, Mr. Weare, has been a great improvement over that of his predecessor. The monopoly of transportation sought to be established has been abolished, and competition is free to guides and hotel keepers. This naturally has the effect of reducing rates, and will do so still more, for the charges have not yet reached bed-rock. When this desirable result has been achieved, the Yellowstone National Park will become one of the most popular resorts for tourists of all nations, who will be amply repaid by an inspection of one of the few remaining regions of the earth where thermal activity still reaches its surface, and of the grand and impressive scenery which surrounds it.—*Amer. Naturalist.*

A NOVEL PAPER-CUTTER.

OUR Boulogne correspondent writes: "Some months since Holkar, while on a visit to Lord Dufferin, saw his lordship going through the process of cutting his newspapers and reviews. The Indian potentate asked for the ivory paper-knife, promising another in return. The prince returned recently to Government House, taking with him a young elephant. The animal had had its tusks shaped and sharpened, and between the rajah's two visits to Calcutta had undergone a training in secretarial work. When led into Lord Dufferin's presence, it took up some newspapers with its trunk, cut them, and placed them on a carpet in an orderly fashion."—*London Times.*

THE EFFECTS OF LIGHTNING STROKE.

AT a recent meeting of the Berlin "*Verein fur Innere Medicin,*" Dr. Liman described the changes present in the bodies of two men who had been killed by lightning when taking shelter under the trees of the Thiergarten. In the one subject, the hair over the left temple was singed, and the skin from the left ear to the shoulder-blade was discolored a brownish-red, the chest and abdomen being covered with red and white streaks. Reference was made to the dendritic figures described in many cases, and attributed often to impressions of twigs, leaves, etc., and in this body there was a figure which could be compared to a palm-leaf, but which was undoubtedly due to the contact of the folds of the shirt. The parts thus pressed upon remained white, the surrounding skin being reddened. The apex of the heart was the seat of an irregular cavity, which communicated with both ventricles; evidently the lightning stroke had caused rupture of the organ. In the other case, the skin and hair were similarly excoriated and singed, and numerous ecchymoses occurred beneath the serous layers of the pericardium and pleura; the lungs were much congested. Here death was evidently due to asphyxia. Dr. Liman mentioned, and Professor Leyden confirmed, the fact that death by lightning is occasionally accompanied by rupture of internal organs, as the brain and liver.—*Lancet.*

FARM BUILDINGS, WITHDEANE ESTATE

GLAZED WARE FINIAL.

THIS grand 16th century finial is a fine example of French ceramic ware, or glazed terracotta, and it is illustrated both by geometrical elevation and a cross sectional drawing. This latter shows the clever building up of the structure by means of a series of five pieces, overlapping each other, and kept rigid by means of a stout wrought-iron upright in the center, bolted on to the ridge, and strapped down on the hip pieces. Its outline is well designed for effect when seen at a distance or from below, and its glazed surface heightens the artistic colorings, giving it a brilliant character in the sunlight, as well as protecting the ware from the action of smoke and weather.—*Build. News.*

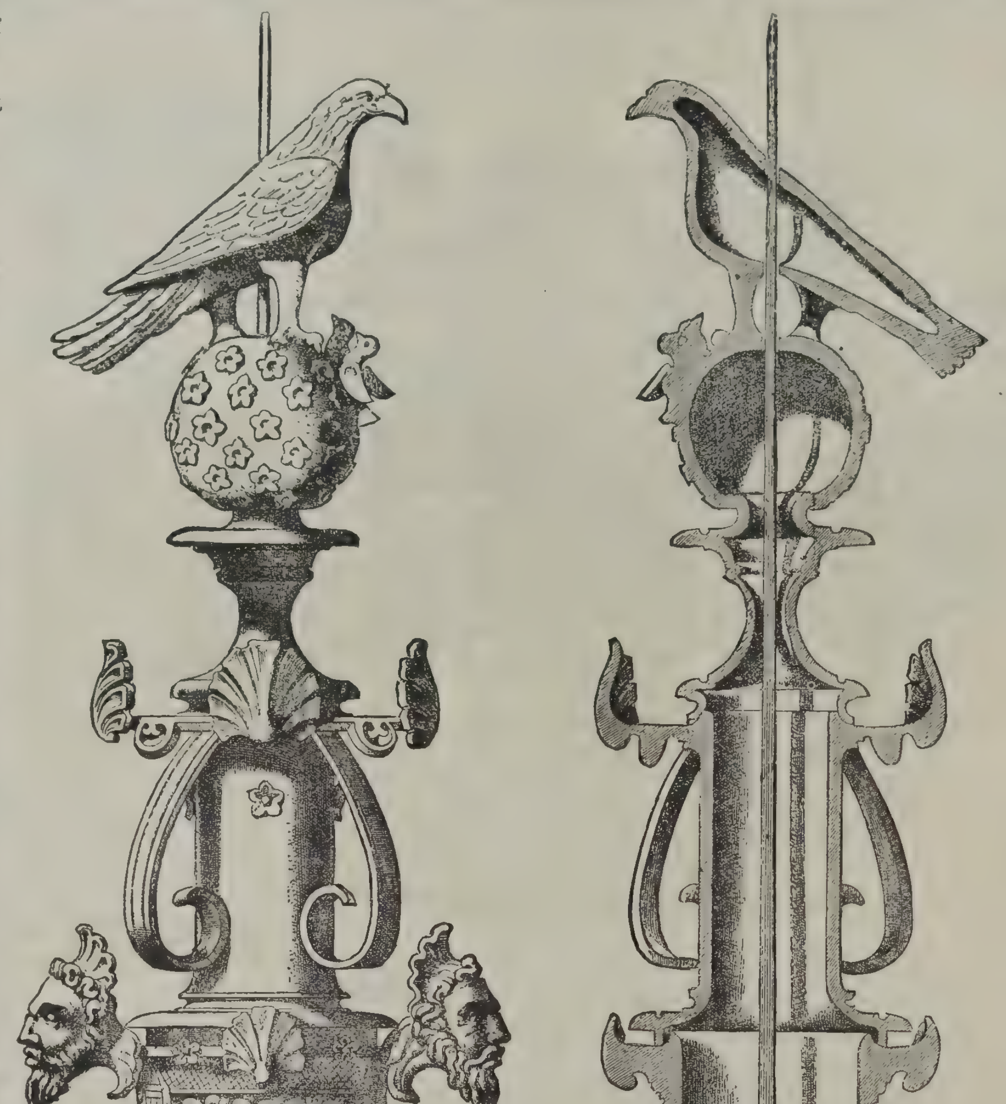
WAGE EARNERS AND THEIR HOUSES.

MANUFACTURERS AS LANDLORDS.

AMONG the more prominent movements of the day for the improvement of the condition of the working men are those which are growing into fashion with large manufacturing incorporations. Their promise lies immediately in the fact that they call for no new convictions of political economy, and hence have nothing disturbing or revolutionary about them. Accepting the usages and economical principles of industrial life, as the progress of business has developed them, an increasing number of large manufacturers have deemed it to their interest not only to furnish shops and machinery for their operatives, but dwellings as well, and in some instances the equipments of village life, such as schools, chapels, libraries, lecture and concert halls, and a regime of morals and sanitation. Probably the most expensive investment of this sort in the United States, if not in the world, by any single company, is that of Pullman, on Lake Calumet, a few miles south of Chicago, an enterprise as yet scarcely five years old. It is by no means a novel undertaking, except in the magnitude, thoroughness, and unity of the scheme. Twenty years ago the managers of the Lonsdale Mills, in Rhode Island, were erecting cottages on a uniform plan and maintaining schools and religious services for their operatives. More recent but more extensive is the village of the Ponemah Cotton Mill, near Taftville, Conn. These are illustrations merely of similar investments upon a smaller scale elsewhere. But the European examples are older, such as Robert Owen's experiment at New Lanark in Scotland, Saltaire in Yorkshire, Dollfuss' Mulhausen Quarter in Alsace, and M. Godin's community in the French village of Guise, which are among the more familiar instances of investments originally made on business principles, with a view to the improved conditions of workmen. New Lanark failed as a commercial community through the visionary character of its founder; the Godin works at Guise have passed into the co-operative phase within the past five years, but Saltaire and Mulhausen still retain their proprietary business features.

The class of ventures of which these instances are but the more conspicuous examples has peculiar characteristics. They differ from the Peabody and Waterlow buildings of London, described in *Bradstreet's* last August, from Starr's Philadelphia dwellings, and from the operations of the "Improved Dwellings Association" of New York in these particulars: the latter are financially a pure question of direct investment; are mainly concerned with life among the poor of cities, and, whatever philanthropy may be in their motive, are capable of adaptation to any class of citizens. The former, while investments also, are composite, the business of manufacturing being associated with that of rent collecting and sharing its profits and losses; their field of operations is almost invariably rural, and tenancy is restricted to the employes of the proprietor. On the other hand, they differ from all co-operative and socialistic communities in that they are an adaptation to existing circumstances, propose to demonstrate no new theories of economics, are free from all religious bonds, do not depend on any unity of opinion, and do not touch the question of the proper distribution of wealth.

It is, of course, no new thing for owners of large factories, particularly in country districts, to furnish tenements for their operatives, and oftentimes it is quite indispensable that they should, because there would otherwise be no accommodation for their workmen. What is recent and exceptional is the spread of the belief that it pays to make the accommodations furnished healthful, convenient, and attractive. The sources of profit from this careful provision are these: the proprietors have control of the territory, and are able to prescribe regulations which keep out the saloon and disreputable characters, and at once there is a saving in police and court and poor taxes; for the same reason the workmen are more regular and steady in their labor, for there is no St. Monday holiday, nor confused head and uncertain hand; the tenants are better able to pay their rents, and when their landlord and employer are the same person, he collects his rent out of the wages; the superior accommodations and more settled employment act strongly against labor strikes. It will be seen that the larger and better product of labor is a great factor in the profitableness of such enterprises, and that it arises from the improved character of the laborer, on the same principle that a farmer's stock pays him best when it is of good breed, is warmly housed, and well fed. Against the operations of the London Peabody and Waterlow funds it has been alleged that they dispossess the poor shiftless tenant and bring in a new class, so that they do not improve the condition of their tenants, but afford opportunity for better ones to cheapen the price of their accommodations. The manufacturing landlord cannot wholly do this, because the first thing he has to consider is whether the applicant for a dwelling is a good workman, not whether he can be trusted for his rent. His labor he must have. His outlook is to make that labor worth more to him, by placing it in the best attainable surroundings. Can this be done? If so, the ends of humanity are answered as well as the purse filled, for both interests correspond.



GLAZED WARE FINIAL.

Mr. Pullman, who founded the enterprise on Calumet Lake, has uttered sentiments like these, and has proved that in this instance it does pay to make his workmen's families comfortable, and secure from sickness and temptation. As a financial operation Pullman is profitable. There are now 1,700 dwellings, either separate or in apartment houses, in this town, where five years ago the prairie stretched on every side unbroken. Every tenement is connected with common sewerage, water, and gas systems, in which the most scientific principles and expert skill have been applied. The price of tenements ranges from \$5 per month for two rooms in an apartment house to \$16 for a separate dwelling of five rooms; but there is a different class of houses for clerks, superintendents, and overseers. The average price per room is \$3.30 a month, or nearly twelve per cent. higher than in Massachusetts manufacturing towns, where it is \$2.86. Taking each tenement at an average of three rooms, this rate will pay six per cent. on an investment of \$3,140,000, without taking into account taxes and repairs, or say six per cent. on \$3,000,000. But one source of profit of great moment must not be overlooked, and it is the appreciation of real estate by the increase of population. This is a small factor in a great city, at least so far as concerns the humbler grade of dwellings, but in the country it is enormous. A tract of land which has been a farm becomes a village of from 1,000 to 10,000 inhabitants. Its value advances by leaps and bounds.

At Pullman, in addition to the shops and dwellings, there are trees and turf-bordered malls and squares, a church, a theater, a free library with reading rooms, a public hall, a market house, provided at the expense of the company. Liquor can only be sold at the hotel to its guests, and then under restrictions. There is a system of public schools under a board of education, which is about the only civic organization, strictly speaking, in the community. One man suffices for police duty, and he made but fifteen arrests in the last two years. It is reported that the death rate so far, including the mortality from accidents, has been under seven in 1,000 per annum. In Great Britain the rate is a small fraction over 22 in 1,000. The vital statistics of the United States show a smaller mortality than this, but they are rendered abnormal by the heavy immigration which pours into the country. Emigrants are, in the language of insurance men, a selected class. They are usually at the most vigorous time of life and of hardiest and most enterprising spirit.

They leave behind them the very young and the old and those enfeebled by disease or habits. To this cause must be attributed in part the exceptional record of Pullman in death rate, as it is a new town. Yet there can be no question that the sanitary conditions of the place are excellent. It is difficult in mixed enterprises of this nature to tell what the rate of profit upon the tenement part of the business is, since the rental and the factory react upon each other; but in the American instances quoted in this article the investment as a whole is remunerative. In the Godin operations at Guise, which have been co-operative for the last five years, the capital is put at \$1,320,000, and the net earnings have averaged during that time \$204,640 per annum, or 15½ per cent.

At Pullman a demand has arisen on the part of the tenants for a chance to acquire proprietorship in their homes; and while the company has withheld the privilege from its original purchase of 3,500 acres, it has bought adjoining land, where it offers to advance money for building, and to take pay in monthly installments. This assimilates so much of the enterprise to that at Mulhausen, and shows the drift toward a co-operative phase of capital and labor. Indeed, this tendency will probably prove to be strongly characteristic of all similar schemes as fast as they attain to any magnitude. Tendencies which can be resisted in communities of few hundreds become overpowering when the population rises into thousands. But from the purely commercial point of view, this drift is hardly to be deprecated, so long as the operation of selling houses returns the capital and interest safely.

Projects of this nature go far toward modifying the stress of antagonisms between labor and capital, because if they are successful these are harmonized to an appreciable extent, and this gives public interest to them. The eventual adjustment must come, not from convictions of duty, doctrinaire opinions, or sentiments of sympathy, but on business principles, and it is a sure step in advance to show that self-interest and philanthropy are in accord. How great the field for experiments of this nature is in the United States may be gathered from the census of 1880, which shows 2,718,805 persons employed in the industrial establishments of the country, with an annual production of \$5,342,000,000, and a capital of nearly half that amount. Of these hands and values nearly two-thirds belong to the north Atlantic States.—*Bradstreet's.*

ENGINEERING INVENTIONS.

A boiler flue cleaner has been patented by Mr. James M. Ferguson, of New Orleans, La. The nozzle has a central aperture in its disk portion, with an inner tubular extension, around which is an annular space opening through the disk portion, and connecting with a steam chamber of the nozzle, whereby the flue cleaner is operated to remove dirt and soot and prevent the formation of scale.

A slide valve has been patented by Mr. William Mitchell, of Altoona, Pa. It has a central exhaust chamber, and the steam inlet port is formed clear through the body of the valve, the tops or outer edges of the side bars of the valve at each side of the exhaust chamber standing back of the plane of the contact faces of the chamber walls which form the valve face, so as partly to equalize the pressure at both sides of the valve and reduce its length of travel.

A revolving cylinder engine has been patented by Mr. John J. Blair, of Cincinnati, O. Combined with a fixed piston and a revolving cylinder surrounding it, with a cylindrical chamber in the piston having a sliding valve, there is a rod connected with the revolving cylinder and the sliding valve, a sleeve surrounding one end of the rod, weighted levers on the sleeve, and a plate on the ends of the rod against which the ends of the weighted levers rest.

AGRICULTURAL INVENTIONS.

A cutting apparatus for reaping and mowing machines has been patented by Mr. Elias Hazelton, of Brantford, Ont., Canada. It consists of an endless chain of knives, made by chain links, with a projecting bracket from one side adapted for the attachment of a knife, so that when the chain is run back and forth along a guide rail the edges of the oppositely moving knives cut against each other.

A seed planter has been patented by Mr. Charles C. Kieruff, of Starke, Fla. It is a light wooden box, tapering to form an edge like a spade on its lower end, with a slanting partition to guide the seed, and a vertically-sliding gate, with other novel features, the device to be operated by hand to make the holes in the ground, and mechanically drop therein cotton, corn, and similar seed.

MISCELLANEOUS INVENTIONS.

A hat and bonnet fastener has been patented by Clara Abell, of Geddes, N. Y. Combined with a hat or bonnet is an elastic band having one end secured to the hat or bonnet, and having a hair pin attached to the opposite end.

A lumber drier has been patented by Mr. Orman A. Duke, of Clanton, Ala. It is so constructed that all the hot air and gases of the furnace are utilized directly in the drying of the lumber, while the flues are so arranged that there is no danger of the lumber being fired by sparks escaping from the furnace.

A toy cap exploder has been patented by Mr. Henry M. Dixon, of New York city. Its construction is such that, in exploding a paper cap, a representation of a bird perched upon the toy will fall off as if shot, and the sparks will be prevented from flying about.

A rosin holder for violins has been patented by Mr. James W. Angus, of Macon City, Mo. It consists of a plate having lugs for holding it on the violin, with spring jaws for holding the piece of rosin, whereby the rosin will be held in such a manner as to be at all times handy and convenient.

A ring holder for displaying rings to the best advantage has been patented by Mr. Max Eising, of New York city. It is a clamp made of sheet metal, with a slotted tongue, on one end of which a bow is formed, from which a bent tongue projects through the slotted tongue, and has a curved prong on its end.

A lock has been patented by Mr. William G. Mumma, of Warrensburg, Mo. It can be made right or left handed, and the case may be so arranged that it will serve for either a mortise or rim lock, all parts being of cast iron except the springs, making a cheap lock for barns and outhouses.

A braid board has been patented by Mr. Charles E. Barnes, of Paterson, N. J. It is made of two flexible parts connected at the ends, so that the board or card of which it is made, and the braid wound thereon, may be opened out and placed upon a reel for convenience in unwinding the braid from the board.

A wheel fender for carriages has been patented by Mr. James M. Todd, of Albert Lea, Minn. It is a movable or rotatable fender for the forward wheels of vehicles, held to the carriage axle by novel means, to prevent mud and dirt taken up the wheels from being thrown on the carriage or its occupants.

A money envelope has been patented by Mr. Patrick Scanlan, of Ida Grove, Iowa. It is of novel construction, for the use of express companies carrying valuable packages, so that after it has been sealed it will be secure against abstraction of its contents without breaking the seals or cutting or tearing it open.

A foot rest for shoeing horses has been patented by Mr. Benjamin Lear, of Woodstock, Vt. It is for supporting and holding horses' hoofs while paring, shoeing, and clinching the nails and finishing, and can be adjusted very easily to any desired height, while the horse's leg is not twisted or strained, and the hoof cannot slip.

An adjustable seat has been patented by Mr. Manoah Miles, of Russell, Kansas. Two slotted upright end pieces have a swinging seat board hung between them, with a hinged wing and a cross rod or pivots, passed through notched curved slots in the uprights, making a seat which can be easily adjusted for a lounge, invalid chair, etc.

A gas pressure regulator has been patented by Mr. Robert F. Hatfield, of New York city. It is contained in a case holding water or other liquid, and is so made as to give notice, by the flaring of the lights, when the liquid needs replenishing, and shut off the gas before the liquid becomes so low as to break the seal of the regulator.

A split gear has been patented by Mr. James Lawlor, of Fall River, Mass. Combined with a flanged hub are two or more wheel sections bolted on the flange, the sections having side recesses for receiving the flange, the wheel being readily fastened on or removed from a shaft without requiring the removal of other wheels and pulleys.

A safety stirrup has been patented by Mr. Henry Coates, of Newark, N. J. It has a pivoted guard to prevent the foot from entering too far into the stirrup, the latter being made in one piece and the entire guard in one piece, avoiding the necessity of several castings, while there is no need of a spring to hold the guard against the stirrup.

A bobbin for sewing machines has been patented by Mr. William W. Ford, of Elmira, N. Y. It has one loose head, with a spring to engage therewith and lock it closed on the barrel, to catch and hold the end of the thread on the bobbin preparatory to filling, and for afterward releasing the thread from its lock, saving time in filling, avoiding breakage, etc.

A telegraph insulator has been patented by Mr. Benjamin N. Deblieux, of Bay St. Louis, Miss. It is composed of two longitudinal sections placed together to form a joint in the middle and retaining the wire between them, with devices for holding the sections together, to support the line wire without wrapping or cutting, and altogether obviating a tie wire.

A bit fastening for bridles has been patented by Mr. Daniel Waters, of Wilkesbarre, Pa. This invention consists of a bit ring on which is formed an annular recess, with a plate to which the bit wires are fastened, the plate being placed around the annular recess formed on the bit ring, to prevent rapid wear of the bit end.

An artist's sketch book has been patented by Mr. William T. Brundage, of Brooklyn, N. Y. Combined with an artist's box are socket pieces on one end and a palette fitting in the box having at one end hook clips fitting in the sockets, to hold the palette on the end of the box, so that the holding of the palette in the same hand with the box will be facilitated.

A comb attachment for shears has been patented by Mr. Daniel M. Young, of St. Louis, Mo. The scissors blade has screw-threaded apertures near its opposite ends, through which pass thumb screws, fastening the comb through similar apertures in the back of the latter, the comb thus attached serving as a guard and to regulate the length of cutting the hair.

A vehicle axle has been patented by Mr. James I. McCalop, of Clinton, N. C. It has a cross slot in which is placed the tongue of the journal made separate from the main body of the axle, with other novel features, providing for adjusting the wheels upon the axle when worn at the hub, and at the same time maintaining them at the same distance apart.

A combined overshoe and leggin has been patented by Messrs. Henry Rudolph and Henry Schwenk, of Rico, Col. This invention covers novel details of construction and combination of parts for a shoe and leggin suitable for wear in cold mountainous districts, for warmth as well as for protection of the feet and ankles in a rough country.

An electric regulator for dampers has been patented by Mr. Wilson E. Facer, of Cleveland, O. Combined with a flue and its dampers, magnets and armatures are made to open and close a damper, a battery and thermostat having contact points for directing an electric current to automatically maintain any desired temperature for which the device may be set.

A sash frame, holder, and casing for carriages, cars, and other uses has been patented by Mr. Albert Ayers, of Rahway, N. J. The casing has a curved groove with a "throw over" in the bottom of its throw over sash groove, and the sash frame has spring friction holders, the improvement being designed to keep sashes from rubbing or rattling, and to hold them firmly in position.

A ribbon and lace exhibitor and measurer has been patented by Messrs. William B. Gleason and Milo J. Harrington, of Albion, Pa. It consists of a drum or roller having an eccentric hub, while there is a reciprocating and swinging arm operated from the hub, and a counting wheel operated from the arm, whereby ribbons and lace may be measured automatically as they are drawn from the holder.

A photographic printing frame has been patented by Mr. William H. Lewis, of New York city. It has one or more swiveling locking springs applied to its back board and ears or lip pieces applied to the frame, to engage positively with the locking ends of the springs, the ears or catches being of a novel construction, and the whole calculated to allow of the progress of the printing being watched without danger of shifting the paper.

A polishing paper has been patented by Mr. Robert J. White, of West New Brighton, N. Y. Unsized paper is coated with a solution of rotten stone, pumice, or other polishing substance by making a solution of the latter in water of about the consistency of cream, the paper being then dried, when the polishing material is mechanically held in the interstices of and on the surface of the paper in a form convenient for use.

A portable hay and cotton press has been patented by Mr. Charles L. Barnard, of Byhalia, Miss. It is supported on wheels, so that it may be run into the field where it is to be used, and the front part of the press carries a windlass mechanism for operating the platen, the middle part being the press box proper, and the rear part being large enough to afford a space for placing hay or cotton, in which the follower reciprocates in forcing the material into the press box.

A telephone exchange forms the subject of a patent issued to Mr. William S. Ford, of Denver, Col. The invention consists of an apparatus for making connections on a switch board between a line strip and a connecting strip by means of a current acting upon the latter and another current operating electrical devices acting upon the line strip, these currents being sent to the switch board from an operator's table having upon it contact points in connection with the electrical devices at the switch board.

NEW BOOKS AND PUBLICATIONS.

CHEMICAL CONVERSION TABLES FOR USE IN THE ANALYSIS OF COMMERCIAL FERTILIZERS. By F. B. Dancy and H. B. Battle. Raleigh, N. C.: The Authors, 1885.

These tables are intended to dispense with the necessity of calculating the amount of any constituent in commercial fertilizers, from the weight of the precipitate obtained.

A GUIDE TO SANITARY HOUSE INSPECTION. By Wm. Paul Gerhard, C.E., New York: John Wiley & Sons, 1885.

It has been Mr. Gerhard's purpose, in writing this little book, to instruct the householder. The main features of sanitary house inspection are unfolded for his benefit, and are presented so briefly and so well that the scholar will find the perusal of his text-book a pleasure rather than a task. So many elements enter into the make-up of a truly healthy home that every housekeeper, no matter how thoughtful he may be, will find a guide in this matter absolutely essential if the inspection is to be at all thorough. Ordinarily, the examination of a house for either purchase or lease is limited entirely to visible qualities, and the points which really determine its healthfulness and desirability are lost sight of. Mr. Gerhard's book goes into a brief analysis of these features, and points out to the would-be tenant the chief matters which he should investigate in choosing either a city or country home. It is not intended to be at all exhaustive, but the hints which it contains, and the special points insisted upon, are calculated to give us healthier homes, and, as a happy corollary, a stronger people.

A SKETCH OF THE GEOLOGY OF CORNWALL. By Brenton Symons. London: The *Mining Journal*, 1884.

Undoubtedly the most striking feature of Cornwall is its ancient mining industries, which have been in almost continuous operation since the days of adventurous Phœnicians. A Cornishman has become almost synonymous with a miner, so wide is the reputation of the country for its mining. Although so old a country, and so well explored, its geology is in some respects still quite obscure. A wide diversity of opinion exists among those naturalists who have given it careful study. In describing the geological features, therefore, Mr. Symons has put forward his own views tentatively, and avoided so far as possible adding to the causes of controversy. He gives an excellent account of the different formations and a full description of the chief mining districts into which the country is divided, with the principal minerals which are made the object of search. Considerable attention is given to veins and their formation, since in few mining countries are the vein systems so complicated as in Cornwall, and probably in none have the theories offered in explanation been more absurd. The book is illustrated with a number of steel plates and a good geological map of the country.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest, cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Minerals sent for examination should be distinctly marked or labeled.

(1) J. A. W. writes: I want an instrument to give the per cent of sugar there is in the crude juice of the sorghum cane. A. The determinations of the specific gravity by the hydrometer are approximately correct; if these are unsatisfactory, you must use a polariscope. We should very much doubt the practicability of the other machine you mention.

(2) C. G. asks what to get to dissolve platinum. A. Platinum is soluble in aqua regia, a mixture of hydrochloric and nitric acids. It is not soluble in any single acid.

(3) F. B. P.—For how to remove marble stains, see SUPPLEMENT, No. 129. For black enamel to apply on bicycles with a brush: Dissolve in about 2 pounds of tar oil, ½ pound of asphaltum and a like quantity of pounded resin; mix hot in an iron kettle, care being taken to prevent any contact with the flame. When cold, the varnish is ready for use.

(4) F. M. Z. asks for a formula that will make tallow soap foam well. A. See "The Method of Making Soap," in SCIENTIFIC AMERICAN SUPPLEMENT, No. 494. Numerous receipts are there given for tallow soaps that "foam well."

(5) C. A. asks: 1. How do the so-called fire eaters perform their feats, or what chemicals do they use to keep the fire from burning them? A. Dilute sulphuric acid, strong alum, and hard soap are the principal substances used. 2. What article which, when mixed with coal oil, will keep it from exploding? A. The explosive properties of coal oil cannot be removed except by so transforming it that it can no longer be used for burning purposes.

(6) F. J. E. desires information as to the value and process of manufacture of dissolved bone, a fertilizer used on wheat fields. A. Messrs. H. J. Baker and Bro., of 215 Pearl Street, New York, are the manufacturers of the fertilizer known as dissolved bone. It is excellent for wheat lands. As manufactured by a New York firm, it contains about 17 per cent of phosphoric acid, and is made by treating the bone with sulphuric acid in the proportion of 0·64 per cent of concentrated acid to each pound of bone.

(7) A. D. S.—Kerosene can be mixed with lard oil in small quantities with good effect for lamps. The kerosene should be 150° test. The quantity used must be determined by a trial as to the smoke-producing results. The browning of a gun barrel will not prevent rusting unless the barrel is oiled or varnished. Inside of barrel should also be oiled. No useful alloys of silver and steel can be made that will not rust.

(8) Student asks how he may obtain transfers or offsets from printed matter upon white paper—plate, litho, and type. A. The following process is given for the purpose of transferring engravings to paper: Place the engraving a few seconds over the vapor of iodine. Dip a slip of white paper in a weak solution of starch, and when dry in a weak solution of oil of vitriol. When again dry, lay a slip upon the engraving, and place both for a few minutes under a press. The engraving will be reproduced in all its delicacy and finish. Lithographs and printed matter cannot so be transferred with equal success.

(9) J. H. I. asks what size return tubular boiler it will take to run two engines, cylinders 2x3, revolutions 250, boiler pressure 100 pounds; and what horse-power; cylinders or crank at right angles; and what size boat they would drive at about six or seven miles per hour? A. Your engines are 3 horse power, and will require a boiler of 40 square feet heating surface. With a 15 inch screw in an 18 foot boat you accomplish six to seven miles per hour.

(10) A. P. asks: What is the difference between coal oil and insurance oil? Also, what is black oil? A. By coal oil, we infer you mean the ordinary burning fluid, or kerosene. This is one of the distillates of crude petroleum, which is probably the "black oil" referred to by you. The "insurance oil" is a high grade of kerosene, having a greater density than the common article and a higher flashing point; in other words, an oil with a lesser tendency to explode than the common article.

(11) L. E. O'M. asks how to cut a pinion of 21 teeth on planer centers that are only divided with the numbers 16, 20, 36. A. By using the 20 index, and slotting the index catch so as to retrograde the index by one-twentieth for each tooth cut. The side of the index catch may be divided so that the length of one index notch represents 20 divisions arranged like a vernier; add one more division for the 21st tooth. Then, by drawing back the catch one division for each index division, the 20 index will produce 21 teeth. Make a trial, marking to see if the arrangement is working correctly before cutting the pinion.

(12) A. M. D.—There is no practical way of destroying the odors of melted tallow or soap boiling except by fire. You may put a close hood over the kettles, and carry the odors in a large pipe of tin or sheet iron to the boiler furnace or to the furnace that heats the kettles. Close all air inlets to the fire except from over the kettles. The only machinery for this purpose in use in this city is a sealed kettle boiled by steam, with a vent pipe extending under a fire, either under the boiler or separated. Such apparatus is used for rendering offal and dead animals for their fat.

(13) W. O. asks: 1. What is the difference between cast iron and malleable cast iron? A. Cast iron is iron that is melted and cast in moulds and used without further treatment. Malleable cast iron is iron that has been cast in moulds, and afterward annealed in annealing ovens for a considerable time to render it malleable. 2. What is meant by volts and ohms, used as terms in electricity? A. A volt is the unit of electromotive force. An ordinary or Daniell or gravity battery produces a current of about one volt. A machine which produces a current equivalent to that of one of Daniell battery will produce about one volt. The ohm is the unit of resistance. It is about equal to 350 feet of No. 9 telegraph wire. 3. What is the power of a chrome battery (bichromate of potash battery) aside of the Grenet? If they will run a 6 candle power incandescent light, how many? A. The bichromate of potash battery produces a current of about 2 volts. To run a 6 candle power of incandescent light will require about 4 to 5 cells of bichromate of potash battery. 4. I noticed, early one foggy morning, in looking at an arc light (Brush), that it had a full purple-pink cast. In looking at the same light on a clear morning through a frosted window (that was from the cold), it made the colors of a rainbow on the window. Is this spectacle natural with the light? A. The purple color of the arc lamp observed by you was probably due to the temporary elongation of the arc, the light produced by the long arc always having a violet tinge. It is not uncommon to see the colors of the spectrum in frost crystals. 5. Have you a book for sale called "Catechism of the Locomotive"? If so, what is the price? A. Yes. The price is $2.50.

(14) D. McP. writes: There is one man maintains that it does not take any more power on the pump to test a boiler that holds 5,000 gallons of water than one that only contains 50 gallons. I say, the more water, the more power on the pump (both boilers being perfectly tight). Will you be so kind as to decide the argument? A. It takes no more pressure on the pump piston to test a large boiler than it does to test a small one, but in testing the large boiler more water will be required to bring it up to the necessary pressure, and consequently more power will be consumed in testing the larger boiler.

(15) J. R.—You are making your magneto electrical machine too small to be of much service. It would not be much more expensive to make it much larger, and the labor of winding the armature would be less. Probably, with so small a machine, 6 sections, each wound with four layers of No. 32 wire, will secure the best results.

(16) C. A. B. writes: In making an electric machine, I used common green glass bottles for supports for the conductor, and the machine worked all right. I tried to better the appearance, and used flint glass rods for supports, and the machine would not work at all, under the same atmospheric conditions. I made two Leyden jars out of green glass and succeeded, and tried several out of good white glass and failed. A. The white glass contains a certain amount of lead, which renders it to some extent a conductor of electricity. The green glass which you used contained no lead and was therefore a better insulator.

(17) R. L. D. asks: 1. What size of wire and cores, and how many layers, will make the strongest electro magnet, using one cell of gravity battery in a circuit not to exceed 40 feet (besides spools)? A. Make the cores of your magnets 2 inches long and ⅝ of an inch in diameter; wind them with ten or twelve layers of No. 24 wire. 2. Why would not vulcanite plates answer in the place of glass ones in a Wimshurst electric machine? A. Vulcanite will undoubtedly answer, but on account of the oxidation of its surface it is not so durable and reliable as glass. 3. Take a copper tube which weighs one ounce per foot and a copper wire of exactly the same weight per foot—which will have the greatest resistance to the electric current? A. There will be no difference. 4. Which would melt first under a heavy shock of lightning? A. There might be a very slight difference in favor of the tube, on account of its surface being extended, so as to radiate more heat than the wire, but we think the difference will be inappreciable.

(18) G. A. C. writes: 1. The SCIENTIFIC AMERICAN SUPPLEMENT contains a description of an electric machine which, say, for instance, were it four times as large, would be sufficient for an arc light. Now, how can I calculate what size machine and wire to put on it if it would operate two lamps, and also how to calculate the wire for using about 30 incandescent lights at different times? A. We believe there is no rule which will enable you to calculate all of the dimensions of a dynamo electric machine so as to enable you to construct a machine to develop a given current; it is largely a matter of experiment. Much depends upon the quality of the iron used in the field magnet and in the armature, in the quality of the copper used for the conductor, and in the relative position of the various parts. 2. Why the United States incandescent machine is self-regulating? A. We believe the automatic regulation is effected by compound winding. For information on the construction of dynamos, consult Thompson's "Dynamo Electric Machines," Gordon's "Electric Illumination," and Dredge's "Electric, Illumination." As you fail to give your P. O. address, we are unable to send the SUPPLEMENT desired.

(19) U. O. C.—Follow the instructions for making an induction coil given in SUPPLEMENT, No. 160, omitting the condenser, and making the iron core removable, to vary the strength of the secondary current. A short piece of iron should be left in one end of the core to operate the interrupter; or, if desirable, you may make the interrupter entirely separate from the coil, winding it with coarse wire and placing it in the battery circuit.

(20) J. C. T. asks: What kind of an instrument is used for registering the degrees of heat in a forge or furnace, and where could I obtain a good description of a simple one? A. The instrument for measuring high temperatures is called a pyrometer. You will find different forms of pyrometers described in SUPPLEMENT, Nos. 198, 33, 228, 358, 172, and 256.

(21) L. O W. asks: 1. What must be the diameter of a lens to reflect a picture 4 inches square to a size of 8 feet at a distance of 12 feet from the screen? A. A lens of 6 inches focus and 2 inches diameter. 2. Are there two lenses used in a polyopticon, or only one? A. Two lenses are used in a polyopticon, arranged on the same principle as the magic lantern, the light being placed on the side of the lens tube, so as to illuminate the picture.

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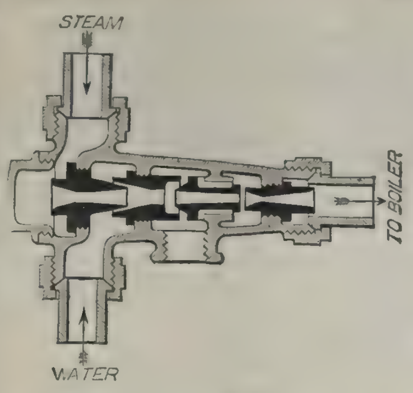

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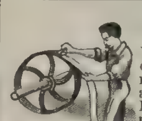

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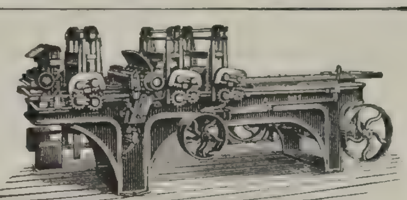

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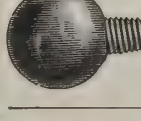

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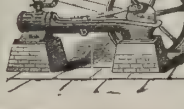

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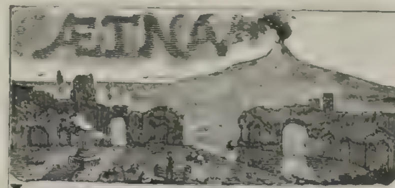

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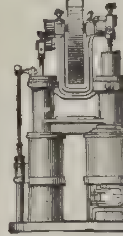

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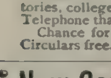

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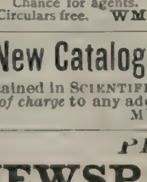

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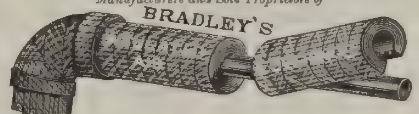

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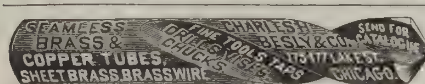

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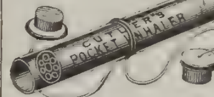

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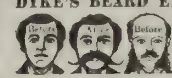

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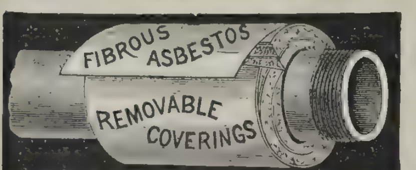

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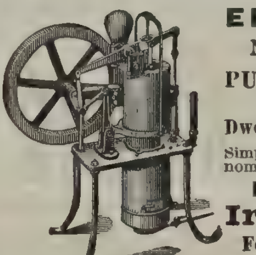

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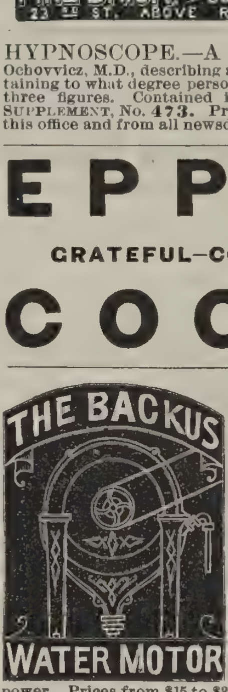

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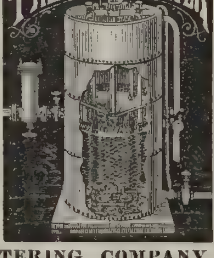

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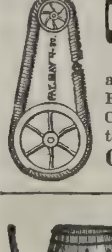

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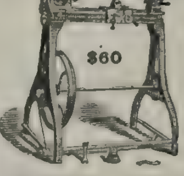

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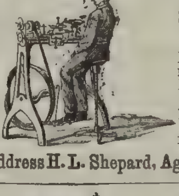

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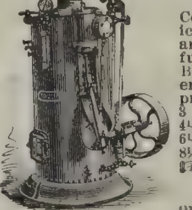

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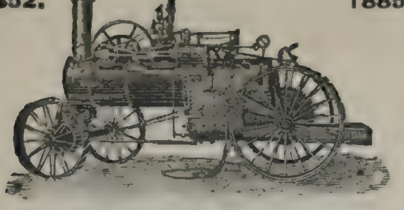

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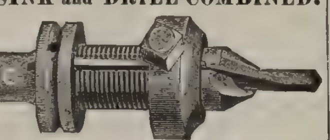

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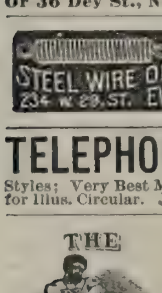

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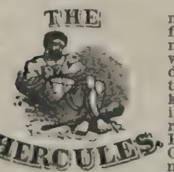

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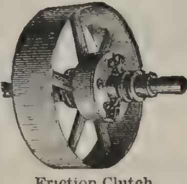

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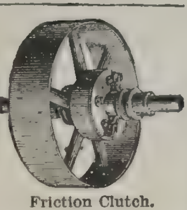

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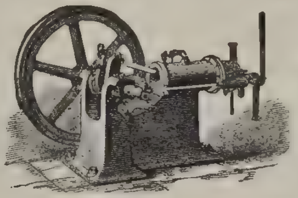

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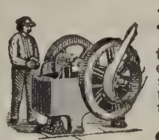

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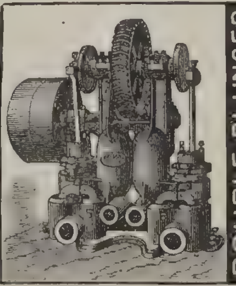

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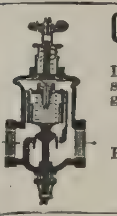

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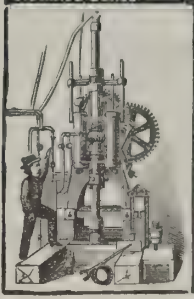

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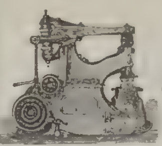

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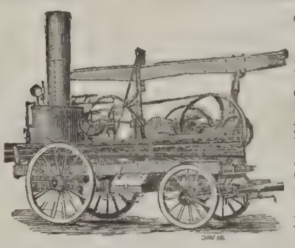

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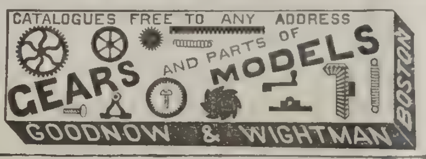

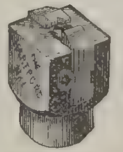

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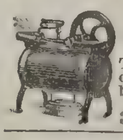

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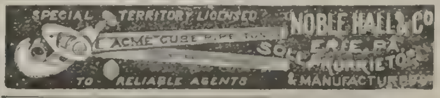

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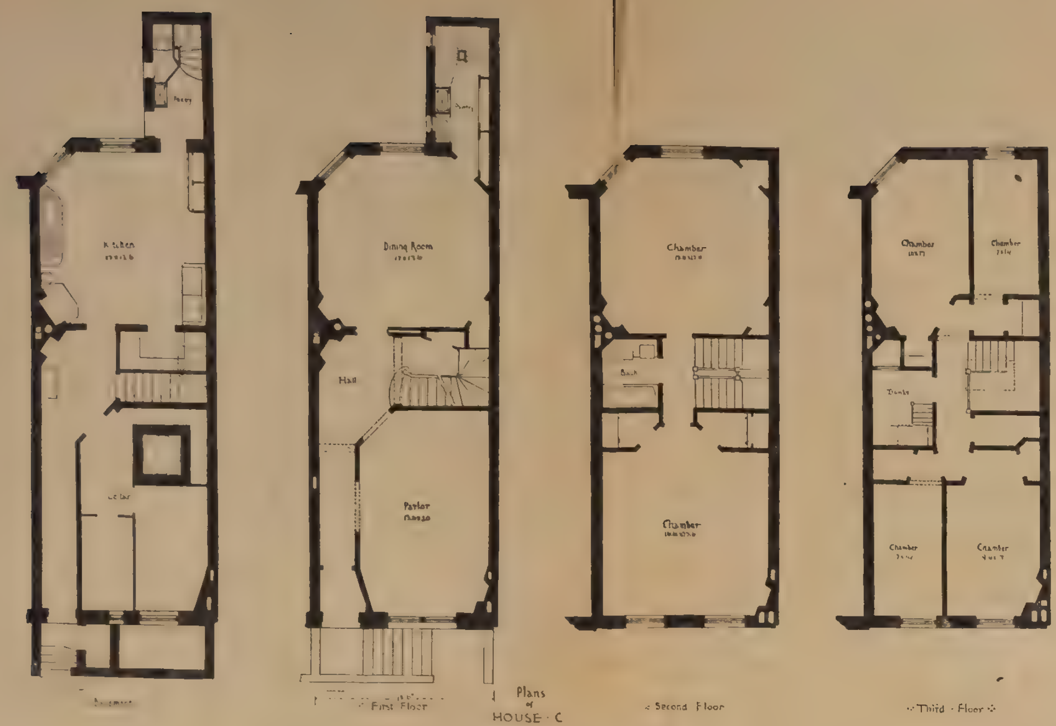

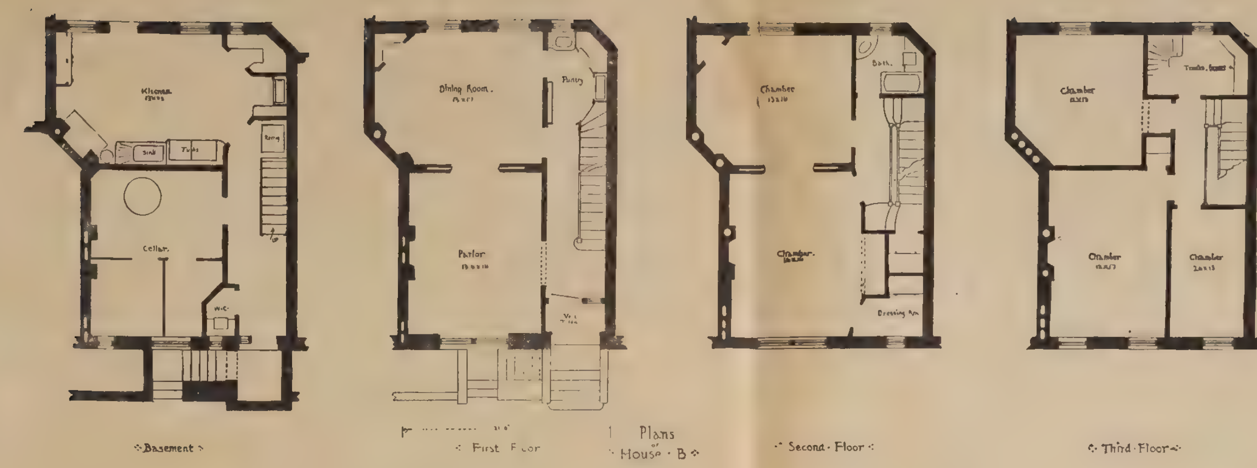

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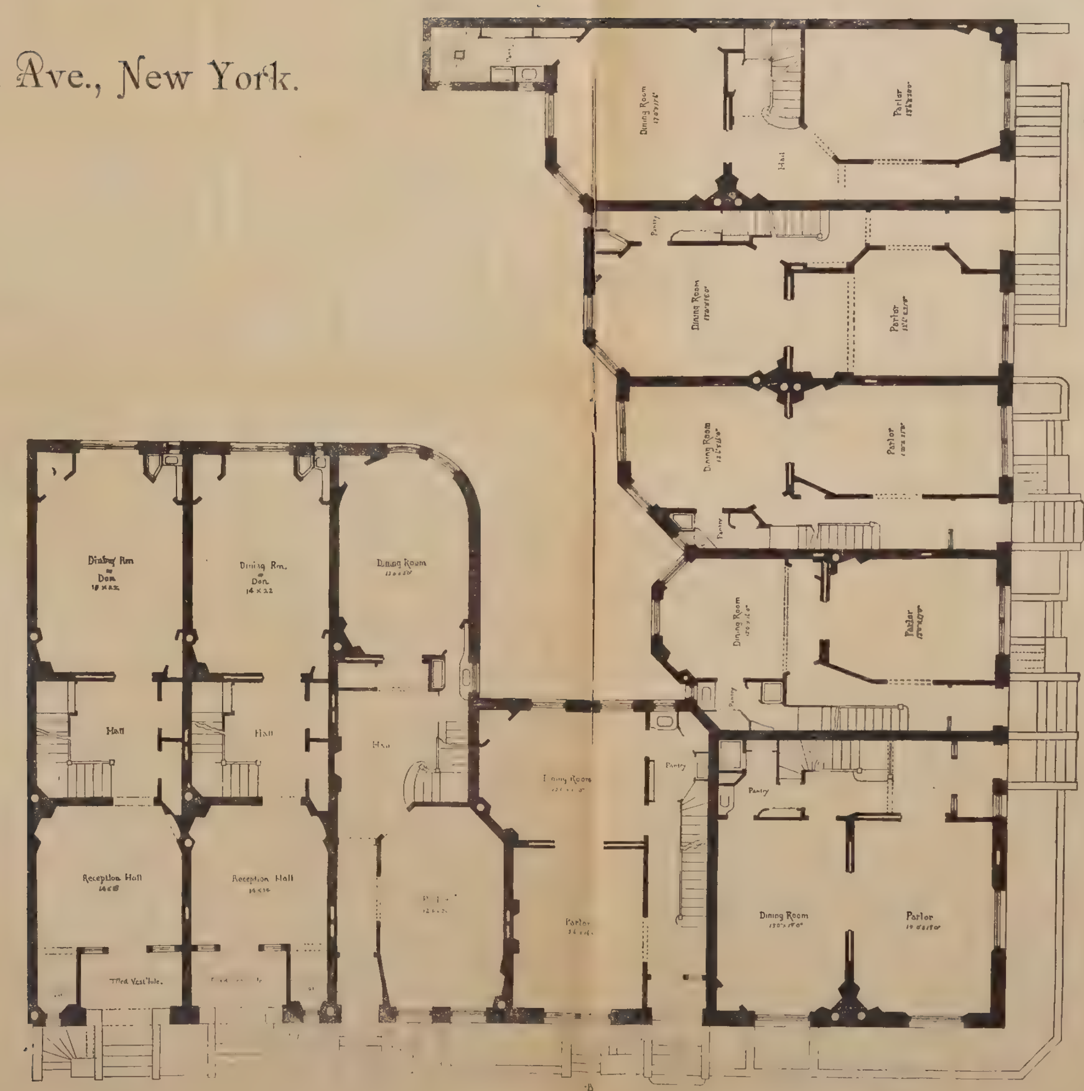

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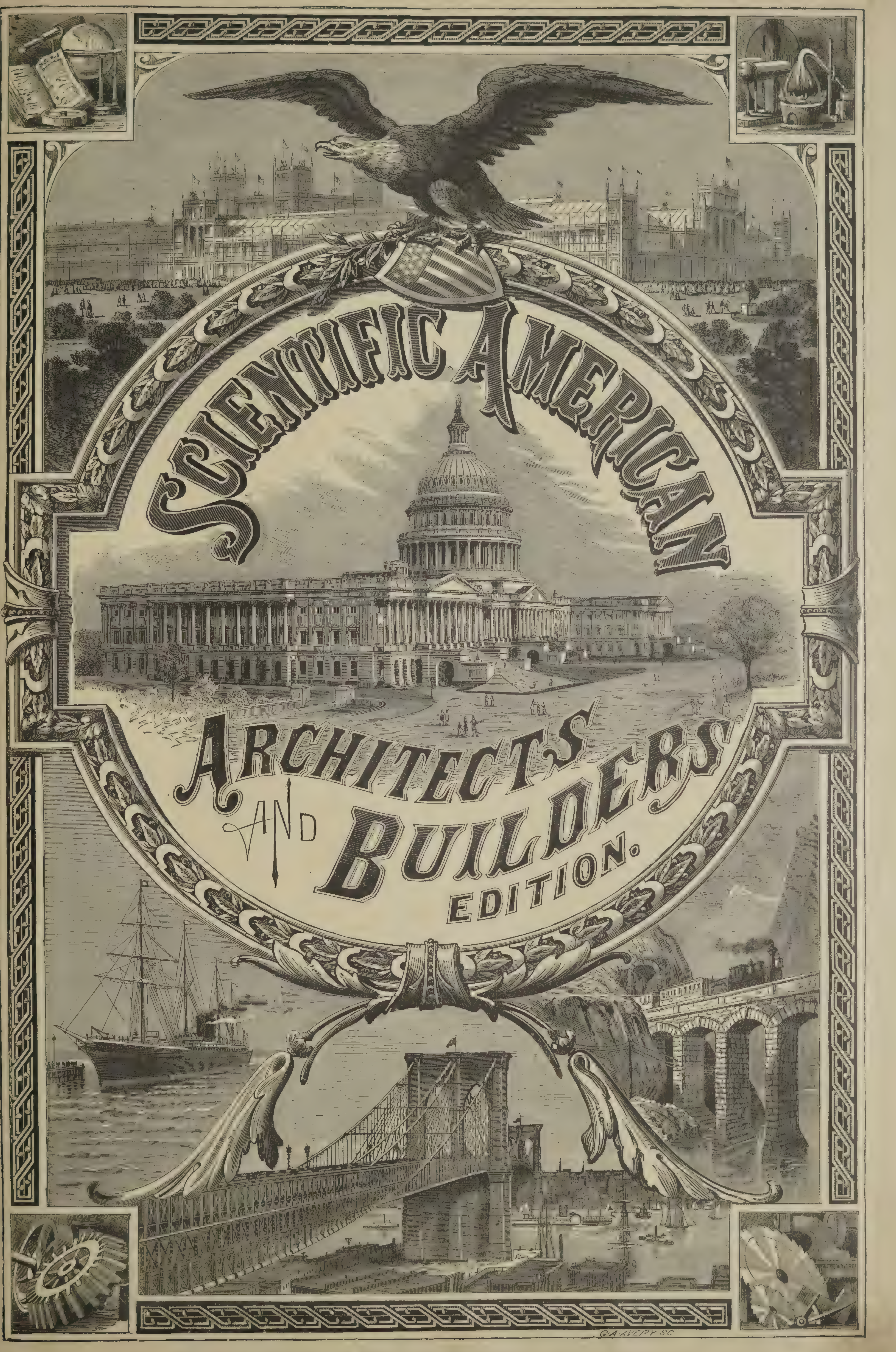

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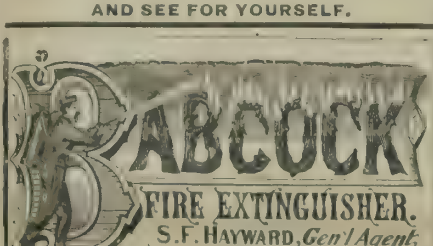

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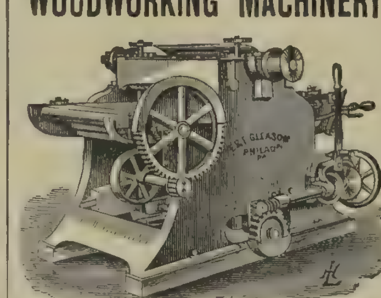

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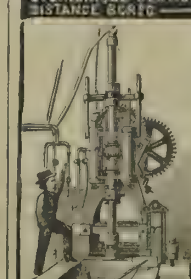

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THE ST. MARY'S FALLS CANAL.

St. Mary's Falls Canal is situated at the village of Sault Ste. Marie, Michigan, and affords a navigable channel by means of which the principal rapids of St. Mary's River are passed. The river is the outlet of Lake Superior, and it empties into Lake Huron. The canal is 15 miles from Point Iroquois, the foot of Lake Superior, and by the present route of navigation is 60 miles from Point Detour, Lake Huron. The rapids known as Sault de Ste. Marie are a little more than half a mile in length, and have a fall of from 16½ to 18½ feet, depending upon the stages of water in Lakes Superior and Huron, the mean fall being 18 feet. From Lake Superior to "the Sault," the fall is only one-tenth of a foot; thence to Lake Huron it is about 2 feet, distributed through a distance of about 20 miles.

Hence "the Sault" is the only obstruction to such navigation as the depth will admit of between the two lakes.

Prior to 1845, the fur trade constituted almost the entire commerce of Lake Superior. At that time the development of copper and iron mines was commenced, and "the Sault" was found to be a serious obstacle in the way of the successful prosecution of these enterprises. The products of the mines, the appliances for working them, and the supplies for the laborers had all to be unloaded from vessels at the foot of "the Sault," carried overland to the head, and there reshipped to their destination. At first the portage was made with horses and wagons. Subsequently a tramway was built and operated with horses, in this way greatly increasing the facilities and ameliorating the conditions.

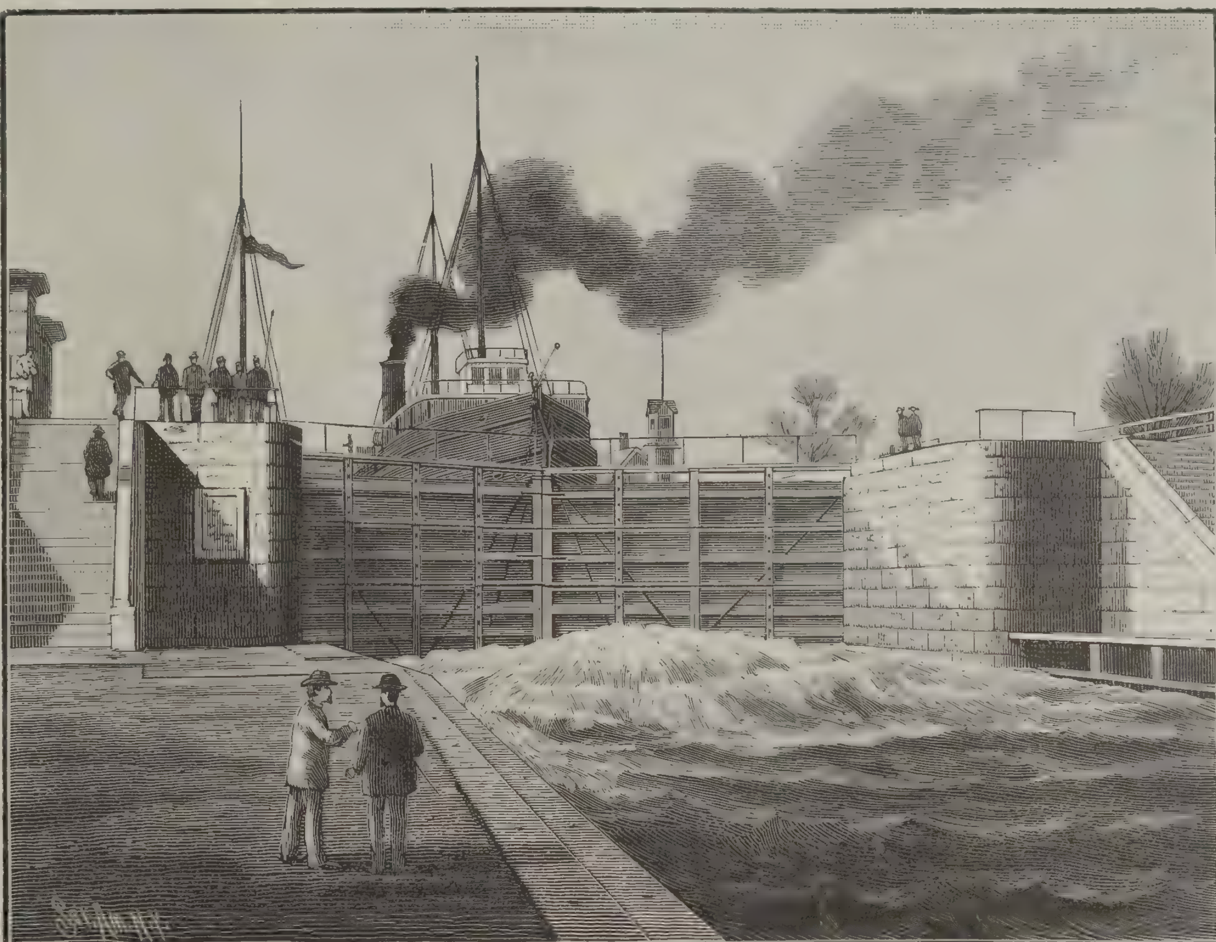


Fig. 1.—ST. MARY'S FALLS CANAL.—END VIEW OF LOCK WITH GATES CLOSED.

As time passed on, steamers and sail vessels were transported upon ways from below to the head of the rapids, relaunched, and used for carrying the freights which were rapidly increasing and rendering the detention and difficulties of the portage at "the Sault" quite too great to be borne.

Application was made to Congress for relief, resulting in the act of Aug. 26, 1852, by which 750,000 acres of land were granted to the State of Michigan, "for the construction of a ship canal around the Falls of St. Mary's in said State."

It must not be supposed that earlier efforts had not been made toward the construction of a canal at this point. (*Continued on page 98.*)


Fig. 2.—ST. MARY'S FALLS CANAL.—VIEW OF THE MOVABLE DAM, CLOSED.

THE ST. MARY'S FALLS CANAL.

(Continued from first page).

They were actually begun in 1837, but the history of these is too long to be here given.

In 1853 the State of Michigan accepted the land grant, and soon afterward made a contract with a private company which undertook to build the canal, and to take the granted lands in payment therefor. The surveys for and the plans of the canal and locks were made under the direction of the late Captain Augustus Canfield, Corps of Topographical Engineers, U. S. A., and the company promptly began operations.

On the 18th of June, 1855, the completed canal was opened to navigation, the company having expended in its construction nearly $1,000,000. In view of the large amount of capital required, no return being possible until after the sale of the lands, the isolation of the locality, inaccessible during the five months of winter, and the severity of the winter climate, which greatly retarded operations, the rapid construction of the canal was a remarkable feat. This was the first ship canal made in the United States. The locks and gates were the largest built in the country up to that time. The depth of water was greater than had been called for in any American canal.

The engineering features were thus without precedent in American practice, but they were well worked out, and the canal proved a remarkably successful one. It was 5,400 feet long, had a width of 100 feet at the water line, with slopes of 1½ to 1, paved where the cutting was not through rock, and a depth of 12 feet at mean stage of water. The locks, located near the foot of the canal, were two in number (now known as the "old locks"), combined, each 350 feet long, 70 feet wide, with a lift of 9 feet, with 12 feet of water in the miter sills. At the time the canal was made, it was deemed of ample capacity to meet the needs of commerce through all future time. The depth was sufficient to pass any vessel on the Lakes, fully laden. The locks were large enough to contain at one time a tug and three vessels, of the average size then in use, which generally constituted a "tow."

By the year 1870, owing to the general improvement of channels and harbors on the Lakes, these dimensions no longer sufficed.

The size of vessels had increased, and they were no longer able to carry full loads on a draught of 12 feet; only one of the largest vessels could be passed at one lockage, and the number of vessels engaged in the Lake Superior trade had increased so greatly that they were frequently delayed at the locks several hours. It became necessary to provide for more rapid lockage, and for the passage of larger vessels. The slope walls of 1½ to 1 had been found objectionable, as vessels frequently came in contact with them below the water line, and sustained damage.

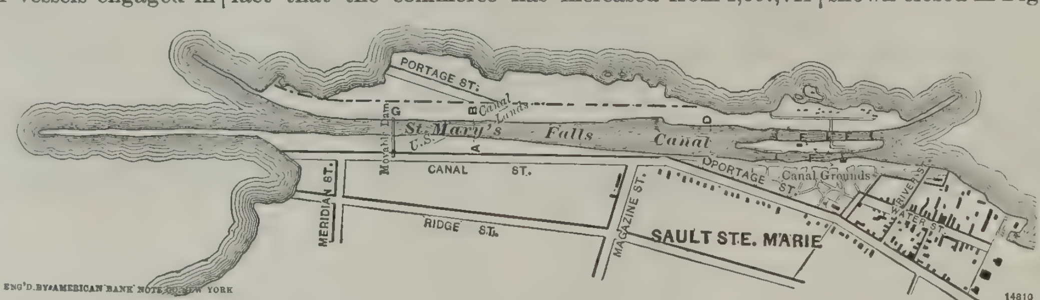


Fig. 4.—MAP SHOWING OLD (E) AND NEW (F) LOCKS AND MOVABLE DAM.

In July, 1870, Congress made an appropriation for beginning improvements, and the charge assigned to General O. M. Poe, of the Corps of Engineers, who in August following submitted a project therefor. The project promptly received the approval of the Chief of Engineers. After some modifications it embraced the following points, viz.:

Build a new lock opposite the old locks, parallel to them, at a clear distance of 100 feet. Take down the guard gates with their masonry, and rebuild them 700 feet nearer the head of the canal, and at a lower level. Form entrances at the new lock—at the foot, by excavating out to deep water, and revetting the channel with pier work; above, by widening the canal from the new lock to the new position for the guard gates. Remove the slope walls, and use a timber revetment with a nearly vertical face. Where the cutting was through rock, the revetment to be placed on the first sound rock reached. Below the base of the revetment, the rock to be cut to a slope of one horizontal to four vertical; where no rock was found, the revetment to be built from the new grade of canal bottom. The improved canal to be made 16 feet deep at ordinary stages. At the time the canal was originally made, it was feared that in the spring of the year ice might be driven into it at the head to such an extent as to delay its opening for navigation. To guard against this, a curve was made near the upper end, so that the direction of the canal above the curve was nearly normal to the direction of the current in the river, which is quite rapid here. This rendered the entrance difficult to a single vessel and impracticable to a tow of three or more. Experience showed that there was really no danger to be apprehended from the ice. The direction of the upper entrance was therefore changed so as to make the canal straight. At the completion of the new lock, replace the guard gates by a movable dam.

Fig. 3.—MAP SHOWING LOCATION OF ST. MARY'S FALLS.

From its beginning to May 1, 1873, the work was in charge of General O. M. Poe, Corps of Engineers, U. S. Army, and from that date to completion in charge of the late General G. Weitzel, of the same corps.

From October, 1870, to completion, the local engineer was Mr. Alfred Noble, to whom the greatest credit is due for the accomplishment of this magnificent work.

The effect of the canal improvement is shown by the fact that the commerce has increased from 1,567,741 tons of freight in 1881 to 3,300,000 in 1885. That is, it has more than doubled in four years.

It is now proposed to further improve the canal by making it 20 feet in depth, and replacing the "old locks" of 1855 by a single one having horizontal dimensions equivalent to the *two*, and a depth on the miter sills of 21 feet.

It is not proposed to disturb the new lock (of 1881), but the increased depth of the canal prism will make available the full depth of 17 feet on its miter sill.

The new lock (of 1881) seems to be nearly perfect. After five years of use, there is no improvement to be suggested. Its operation is rapid, quiet, and in every way satisfactory. It has attracted more attention abroad than at home, especially among the Germans and Russians. Only a couple of weeks ago General Barminsky, of the Imperial Russian Engineers, visited it and fully investigated its operation, devoting a couple of days to the inspection, and upon the conclusion remarking that it is the most effective work of its kind in the world.

The relative positions of the new and old locks are shown at F and E E respectively on the map, Fig. 4. The chamber of the new lock is 515 feet long between the hollow quoins and 80 feet wide, narrowed to 60 feet at the gates; the depth is 39⅛ feet. Its capacity is 1,500,000 cubic feet. The lift of the lock is 18 feet, and the depth of water on the miter-sills 17 feet. The sills are placed 1 foot below the canal bottom, so as to be protected from injury by vessels. A guard gate is placed at each end of the chamber, making the length of the walls 717 feet. The walls for 14 feet from each end are 13 feet wide from top to bottom; then for 121½ feet at the west end and 133½ feet at the east end they are 25 feet wide from top to bottom. Between the wide walls the width is 18 feet for 10 feet up from the foundation, then it narrows in 2 feet for four offsets, 5 feet apart vertically, until the wall is 10 feet wide, at which width it is carried up to within 6 inches of the top of the coping, which is 5 feet wide, as shown in the plan view of the lock, Fig. 5. The masonry is all laid in cement mixed with sand in the proportion of 1 to 1. About 35,000 barrels of cement were used in the construction of the 34,207 cubic yards of masonry.

In the miter walls for the upper lock and guard gates there are nine courses of cut stone, each 2 feet thick. The walls are 14 feet wide at the miter angle, are arched to resist the pressure on the gates, as shown at the right in Fig. 5, and are bonded into the lock walls. The top course of stone is set back 1 foot, so as to leave an offset, on which the oak miter sills rest; these sills project 2 inches above the masonry.

The foundation is on rock throughout. In excavating the lock pit, rock was reached at from 1 to 15 feet above the grade of the lock floor. A floor of timber and concrete extends across the bottom of the lock and 5 feet under each wall; the rest of the wall foundation is concrete, one-half to 2 feet thick on the rock. All the foundation timbers are of pine, 1 foot thick. The miter sills are of oak, 12 x 18 inches, and are held in place by bolts, 10 feet long, fox-wedged and concreted in the rock, and also by timber braces bolted to the rock.

The positions of the four gates, designated as upper and lower lock gates and upper and lower guard gates, are shown at P Q R S, respectively, in Fig. 5. The guard gates are only for use when repairs are being made to the lock; they are opened and closed by means of temporary block and tackle operated by a power capstan. Both leaves of the upper guard gates are provided with valves through which to fill the lock after it has been pumped out. The framework of the gates, shown closed in Fig. 1, is of white oak, and the sheathing is of Norway pine. The weight of one leaf of the upper lock gate is 40 tons, and of one leaf of the lower lock gate 76 tons. Each leaf is thoroughly braced by transverse and diagonal rods, and around each end post are straps bolted to the cross pieces.

Water is let into the lock from culverts under the floor extending from the well, X (Fig. 5), above the upper lock gate to the well, Y, above the lower lock gate. The two culverts are separated by a longitudinal bulkhead, and each is 8 feet square. The floor of the lock forms the roof of the culverts. The water passes into the lock chamber through 58 apertures in the floor, shown in Fig. 5. The total area of these apertures is 174 square feet; this outlet area is increased to 190 square feet by manholes left in the bulkhead at the lower end of the culverts. The combined area of the cross sections of the two culverts is 128 square feet. Having the inlet area considerably less than that of the outlet tends to diminish the velocity of the water when projected upward into the lock chamber. The water in passing out of the lock goes down through the well, Y, which, as well as the well, X, is covered with a grating, thence through short culverts and up through the well, Z.

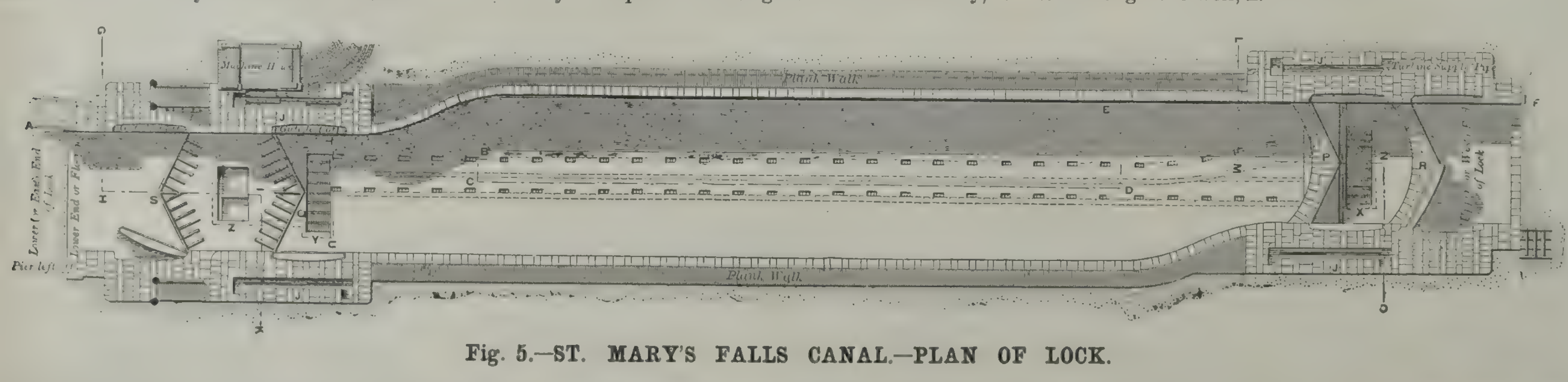


Fig. 5.—ST. MARY'S FALLS CANAL.—PLAN OF LOCK.

The water enters the lock through filling valves, A A (Fig. 6.), located in the well just above the upper lock gate. Each valve, when shut, closes the entrance to one of the culverts. Each valve is 10 feet wide by 8 feet deep, so that when open it gives a clear aperture greater than the cross section of the culvert. Bolted to the woodwork at the culvert is a heavy iron frame in which the axle of the valve has bearings. The valve

consists of a cast iron frame covered with boiler iron and made of such size as to leave a space of ¼ inch at the edges between it and the rectangular frame. Lugs projecting from one face of the valve carry the end of a pitman joining the end of a piston rod operated by water entering the cylinders, L, Fig. 6. Water from the accumulator, described below, can be admitted to either end of the cylinder, which is 15 inches in diameter. The two emptying valves are similar in construction to the filling valves, and are located in the well just above the lower lock gate. Each culvert is complete in itself, so that if an accident should occur to one, or to its valves or engines, the other could still be used.

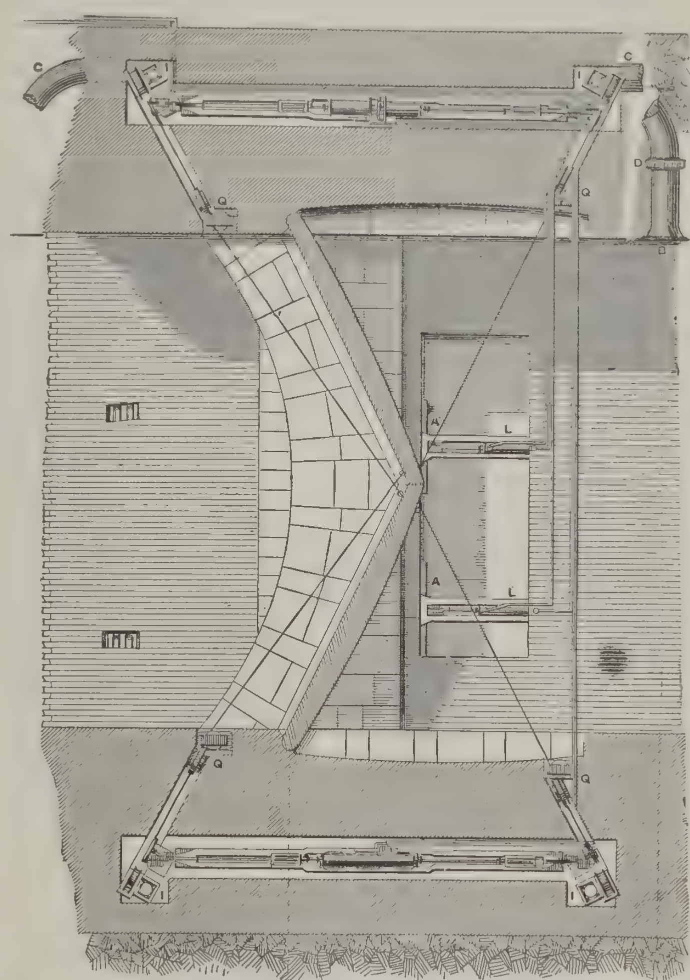


Fig. 6.—PLAN OF UPPER LOCK GATE SHOWING OPERATING MACHINERY.

The power is obtained from two 30 inch turbines, geared to a main shaft, and fed through a supply pipe, B C, Fig. 6, from the canal above the lock. A belt from the shaft runs two force pumps, each having three plungers, which pump into an accumulator loaded so as to give a pressure of about 120 pounds to the square inch. Water is taken from the accumulator to the engines operating the gates and valve.

The interior diameter of the accumulator cylinder is 21 inches, its length 124 inches, and its capacity is 1,859 gallons. The plunger carries a heavy crosshead moving up and down on guides fastened to the iron girders of the machine house. The weight case is suspended from the crosshead by rods. The weights are cast iron plates made to fit the weight case. As the area of the cross section of the cylinder is 346 square inches, it requires 69,200 pounds of weights to produce a pressure of 200 pounds to the square inch. The water enters and leaves the accumulator at diametrically opposite points at the base. When the accumulator is full, the belts which run the pumps are automatically thrown on loose pulleys.

The position of the four gate engines is shown at J J J J, Fig. 5. The interior diameter of the cylinder is 15 inches, and the length 132 inches. The piston rod projects from both ends of the cylinder, as shown in Fig. 6. Water is taken from the accumulator, and is admitted through pipes to either end of the cylinder, and controlled by hand valves. Each crosshead is constructed with two sheaves. One end of a wire rope is adjustably fastened at I, Fig. 6, and, passing around one of the engine sheaves, is led by suitably located sheaves down through the well in the lock wall, around the drum, Q, and to a leaf to which it is secured. The four ropes necessary for the opening and closing of each gate are clearly shown in Fig. 6. When the engine makes a stroke, the end of the rope attached to the gate moves four times as far. With a pressure of 200 pounds per square inch, the total pull on the leaf of the gate is 8,835 pounds, less friction and rigidity of rope. It will be noticed from the drawing, Fig. 6, that each closing rope is attached to the leaf at the opposite side of the lock. Hand power capstans can be used in case the gate engines are disabled.

The centrifugal pump for emptying the lock is run by a belt connected with the main shaft. A power capstan, located on the lock wall near the machine house, Fig. 5, is run by belts from the main shaft, and is used for warping vessels into and out of the lock.

The location of the movable dam, shown in perspective in Fig. 2, is indicated on the map, Fig. 4. It is about 3,000 feet above the locks, and is designed to check the flow of water so that the upper guard gates could be closed if the lock gates were accidentally carried away. It consists of an ordinary swing bridge, one end of which can be swung across the canal. A series of wickets, Fig. 7, are suspended side by side from a horizontal truss hung beneath the bridge and abutting at either end (when the bridge is closed) against heavy buffers securely anchored to the masonry. One end of each wicket can be let down until it rests against a sill, O, in the bottom of the canal. When the wickets are all down, they form a vertical bulkhead or dam, as shown in Fig. 2.

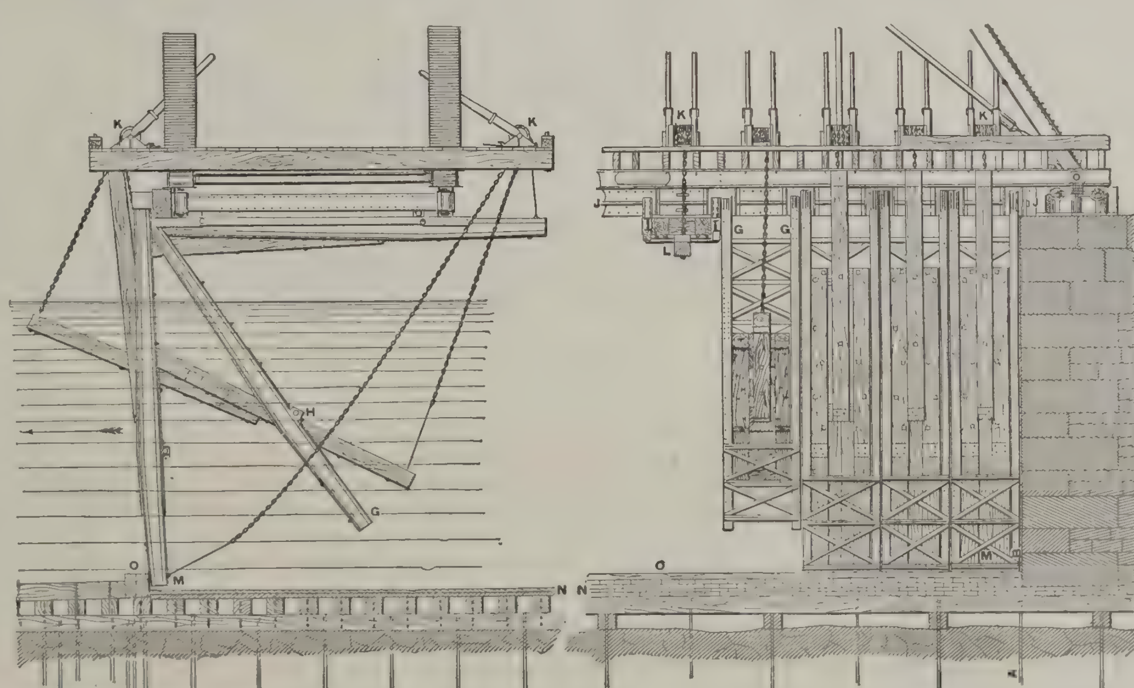


Fig. 7.—THE MOVABLE DAM.—SHOWING THE ARRANGEMENT OF THE WICKETS.

Each of the twenty-three wickets is supported in an iron frame, and turns on an axle, H, and is let down and drawn up by chains attached to each end as shown. Each wicket frame is hinged upon a shaft passing through its upper end. The operating ropes are wound upon windlasses, K, provided with pawls and friction brakes. A wicket fully drawn up is shown at L, another in the act of dropping into position is shown at G, and another after it has been dropped at G, Fig. 7. In dropping a wicket, the down stream end is first let go until it strikes the water, the up stream end is then let go by the run, and the frame swings down until this end strikes the sill, the wicket then lying horizontally in the water and presenting only its end surface to the current. The wicket is then drawn into a vertical position by the chain at its down stream end. When the wickets are in position, there is a space of one inch between the frames. The axle, H, is so placed as to leave the pressure of water on the upper and lower parts of the wicket nearly equal. The dead weight on the truss due to the wickets and frames is 1,600 pounds per running foot, which is counterpoised by brickwork at the other end of the truss.

The total amount expended upon this improvement, up to June, 1885, is $2,400,000.

We wish to acknowledge our indebtedness to Gen. O. M. Poe, by whom these improvements were planned and under whose direction the work has been most successfully carried to completion, for notes and drawings.

COCAINE, like fire or alcohol, is again proved to be a good servant but a bad master. A Chicago physician addicted to its use experimented not only upon himself, but upon his wife and children, until he is a raving lunatic and they are incurable wrecks.

Engineering by the Ancients.

At the meeting of the British Association, the president of the section on Mechanical Science, B. Baker, civil engineer, recalled certain engineering feats of the ancients: "I have no doubt that as able and enterprising engineers existed prior to the age of steam and steel as exist now, and their work was as beneficial to mankind, though different in direction. In the important matter of water supply to towns, indeed, I doubt whether, having reference to facility of execution, even greater works were not done 2,000 years ago than now. Herodotus speaks of a tunnel, 8 feet square and nearly a mile long, driven through a mountain in order to supply the city of Samos with water, and his statement, though long doubted, was verified in 1882 through the abbot of a neighboring cloister accidentally unearthing some stone slabs. The German Archæological Society sent out Ernst Fabricius to make a complete survey of the work, and the record reads like that of a modern engineering undertaking. Thus, from a covered reservoir in the hills proceeded an arched conduit about 1,000 yards long, partly driven as a tunnel and partly executed on the 'cut and cover' system adopted on the London underground railway. The tunnel proper, more than 1,100 yards in length, was hewn by hammer and chisel through the solid limestone rock. It was driven from the two ends like the great Alpine tunnels, without intermediate shafts, and the engineers of 2,400 years ago might well be congratulated for getting only some dozen feet out of level and little more out of line. From the lower end of the tunnel branches were constructed to supply the city mains and fountains, and the explorers found ventilating shafts and side entrances, earthenware socket pipes, with cement joints, and other interesting details connected with the water supply of towns."

Two Forms of Liquefied Air.

In a recent communication to the *Comptes Rendus* on the liquefaction of air, Herr S. Wroblewski states that he has obtained from air two liquids, different in appearance and in composition, which can exist together as separate layers with a perfectly visible meniscus between them. To obtain this result, Herr Wroblewski liquefied at —142° C. a certain quantity of air in the tube of the apparatus which he employs for using permanent gases as cooling mixtures. He then allowed a quantity of gaseous air to enter the tube, so that, the pressure of the gas having become equal to 40 centimeters, and its optical density the same as that of the liquid, the meniscus entirely disappeared. He then slowly lessened the pressure, and at the moment when the gauge indicated a pressure of about 37·6 atmospheres, he saw a new meniscus formed at a point in the tube much higher than the place previously occupied by the vanished meniscus. A few minutes afterward the first meniscus reappeared at the place where it was seen to disappear, and at the same moment two liquids, different in character, were distinctly seen, one on top of the other. The liquids remained separated for several seconds. Afterward a current of very small bubbles formed and ascended, detaching themselves from the meniscus separating the two liquids.

In consequence of this phenomenon, the upper liquid became a little opaque; the meniscus, gradually destroyed by the current, ultimately disappeared altogether; and the last result was a single liquid homogeneous in appearance. In this experiment, air (which is a completely colorless liquid) presents an enigmatical optical phenomenon, which immediately precedes the appearance of the upper meniscus. This part of the tube assumes a feebly orange coloration, which vanishes immediately upon the formation of the meniscus. Nothing like this ever precedes the formation of the lower meniscus. By means of a small metal tube introduced into the apparatus, Herr Wroblewski has succeeded in taking at will a sufficient quantity of either the top or bottom liquid for analysis. While the lower liquid contained 21·28 to 21·50 parts of oxygen, the upper one only contained 17·3 to 18·7 of the same element.

A NOVEL CLOCK.

We take pleasure in presenting to our readers the following description of a differential clock, invented and designed by Mr. H. Conant, of Pawtucket, R. I., and built for him by Messrs. Tiffany & Co., of this

Fig. 1.—THE CONANT DIFFERENTIAL CLOCK.

city, in their best manner. Fig. 1 is a perspective view of the clock; Fig. 2 is an enlarged view of the dials; Fig. 3 is a front elevation of the works with the dials removed; and Fig. 4 is a side view of the diagonal shafts, *a* and *b*, and the differential motion; similar letters refer to the same parts in the different engravings.

There are two principal motions that belong to our planet—one of rotation upon its axis, called its diurnal motion, producing succession of day and night, and another, that of its orbit, or revolution round the sun, called its annual motion, which causes the four seasons of the year. The exact time occupied by its first, the diurnal, rotation is 23 hours 56 minutes and 4·09 seconds, this being a sidereal day, so called, because in that time the stars appear to complete one revolution round the earth. But as, while the earth is rotating on its own axis, it is also traveling forward in its orbit around the sun, it therefore has to turn a little more each day—about one three hundred and sixty-fifth part of its circumference, which amounts to 3 minutes 56 seconds of time—before a given meridian is again under the sun; in other words, it will require 24 hours on an average through the year for the sun to pass from one meridian of a place to the same meridian again. If this difference in time of the two revolutions be multiplied by 365, which is the number of times a meridian has been brought to the sun during the year, the result would be one sidereal day; consequently, the earth in reality turns on its axis 366 times each year.

Now, if a clock were constructed with two works or movements, and, of course, each movement with its own pendulum and weight, one regulated to mark mean solar time and the other to mark sidereal time, it is evident that, as the one would continually gain at the rate of about 3 minutes 56 seconds a day on the other, the time indicated on the two dials would correspond but once in a year; and if this difference in time of the two dials could be automatically recorded on a third dial, it would mark the space which, in consequence of the earth's motion, the sun appears to describe among the stars. This great circle of the sun's apparent yearly motion is divided into twenty-four meridians, and is called right ascension, that measure in the heavens which is the same to the astronomer as longitude is to the navigator. These meridians are not reckoned in degrees, but in hours, minutes, and seconds of time; thus 15 deg. would answer to 1 hour, 1 deg. to 4 minutes, ½ deg. to 2 minutes, and ¼ deg. to 1 minute.

Fig. 2.—ENLARGED VIEW OF THE DIALS.

The clock herewith illustrated accomplishes this object by a most simple and ingenious arrangement of the parts.

Firmly secured on a solid base of metal are two regulators, each having a one-second mercurial pendulum. One of the pendulums is regulated to mean solar time and the other to sidereal time, the dial of the latter being divided into 24 hours and that of the former into 12 hours. The escape wheel shaft of each clock is long enough to reach out through the dial plate, and on the outer part is fitted, with a slight friction, a sleeve. On the inner ends of these sleeves are the beveled wheels, *c d*, of 90 teeth each, and their outer ends carry pointers indicating seconds on the dial plates. Engaging with these wheels are beveled pinions, of 30 teeth each, mounted on the lower ends of the long shafts, *a b*, which are carried up at an angle of about 45 deg. and connected with a differential motion (Fig. 4) controlling the works and hands of a larger dial placed above the two others. This peculiar motion is constructed of a light and accurately turned arbor or shaft, *h*, on which is fastened at right angles a crosspiece, on one end of which is mounted the wheel, *g*. On the shaft, *h*, and engaging with the wheel, *g*, are two larger wheels, *e f*, of 90 teeth each; these wheels are cut on both sides, as clearly shown in Fig. 4. Engaging with these wheels are wheels of 60 teeth each, fastened on the upper ends of the shafts, *a b*. It will be seen that both clocks are directly connected with the differential motion, and also that as long as the wheels, *e f*, which turn in opposite directions, are driven at the same speed, the wheel, *g*, will simply roll on its pivot without altering its position or that of the shaft, *h*. But assuming that the wheel, *f*, revolves twice around while the wheel, *e*, revolves once, then the wheel, *g*, will necessarily follow *f*, and in proportion to the speed of the two wheels, *e f;* but as these wheels move in opposite directions, it consequently follows that one-half the difference in the rates is lost, or instead of making a complete revolution—the difference between 1 and 2—it has only recorded half a revolution.

Now, to compensate for this error—in other words, to regain the half revolution lost—the wheels on the upper ends of the shafts, *a b*, have 60 teeth each, and the pinions at the lower ends have 30 teeth each; and as the driving wheels, *c d*, having 90 teeth each, are connected through the pinions, shafts *a b*, and upper wheels with the wheels, *e f*, also of 90 teeth,

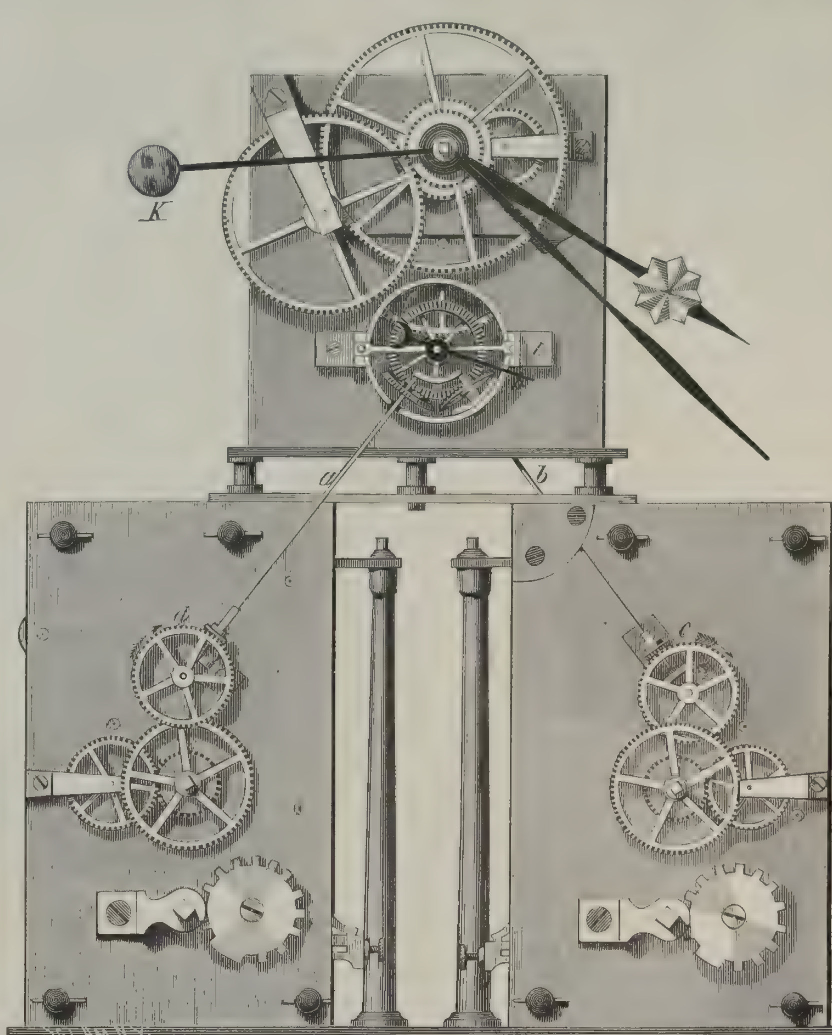


Fig. 3.—VIEW OF WORKS WITH DIALS REMOVED.

it is evident that the wheels, *e f*, revolve twice while the wheels, *c d*, revolve once. By thus proportioning the gears, the exact difference in the speeds of the wheels *c d*, is transmitted to the shaft, *h*, and is recorded by the pointer or hand.

Now, as the clock marking sidereal time gains at the rate of about 4 minutes in 24 hours, or 10 seconds in 1 hour, and as 10 seconds is one-sixth of a minute, it will take 6 hours to complete one revolution of the hand on the differential motion, which is the period of 1 minute in right ascension; 15 days 6 hours is 1 hour, and 1 year is 24 hours in the same measure. The hour hand on the large dial therefore represents the sun's apparent yearly motion among the stars.

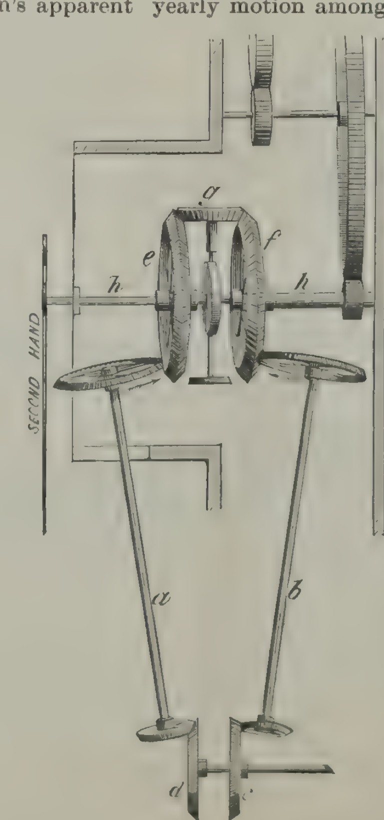


Fig. 4.—SIDE VIEW OF THE DIFFERENTIAL MOTION.

Another hand, k, representing the moon, and making exactly one revolution from one new moon to the next following, has been added.

The hour and minute hands of the different dials are independent of each other, so that one set of hands may be set, if necessary, without affecting the others; but, as has been already said in describing the differential motion, the second hands are connected, so that if either of the clocks should vary one way or the other, the seconds of right ascension would also be affected. In that case it is simply necessary to correct the second hand of that particular clock, when the seconds of right ascension are thereby also corrected.

The shaft, h, carries the second hand of the large dial, and from it an ordinary train of wheels gives minutes and hours; when the hour hand passes entirely around the dial, it indicates that the sun has passed through all the hours of right ascension, and a year of time has been exactly measured off. The hand representing approximately the moon's mean right ascension revolves 254 times in 19 years, or a lunar cycle, and passes the sun 235 times in the same period, making that number of lunations. The large dial also represents that portion of the heavens traversed by the sun and all north of the same, the center being the north pole. A number of the most useful and best known fixed stars are engraved thereon, with their names affixed. The eccentric circle represents the ecliptic; the equator and northern and southern Arctic circles are concentric, the latter being the outer one. The sun touches the outer circle on the 21st of December (the winter solstice) and the inner or northern circle on the 21st of June (the summer solstice). It passes the 24th hour of right ascension and crosses the equator on March 21, or vernal equinox, and at the 12th hour of right ascension it again crosses the equator, on September 21, the autumnal equinox. The signs of the zodiac are also engraved on the dial in their proper positions, as shown in Fig. 2.

The name differential is applied to this clock because the hands of the large dial are indebted for their motion to the difference of speed in the two separate clock movements, the mean right ascension of the sun being always the difference between mean solar and sidereal time; and the inventor's theory is that, starting the hands at zero or 24 o'clock, regulating one to sidereal and one to solar time, they will come together again at the end of the year, that is, the hands of the large dial will have made a complete revolution, and the solar clock will give the exact time to a second when the year is completed, or any portion of the year.

This clock is intended for the Observatory at Dudley, Mass., connected with Nichols Academy, where it will probably be placed the coming season.

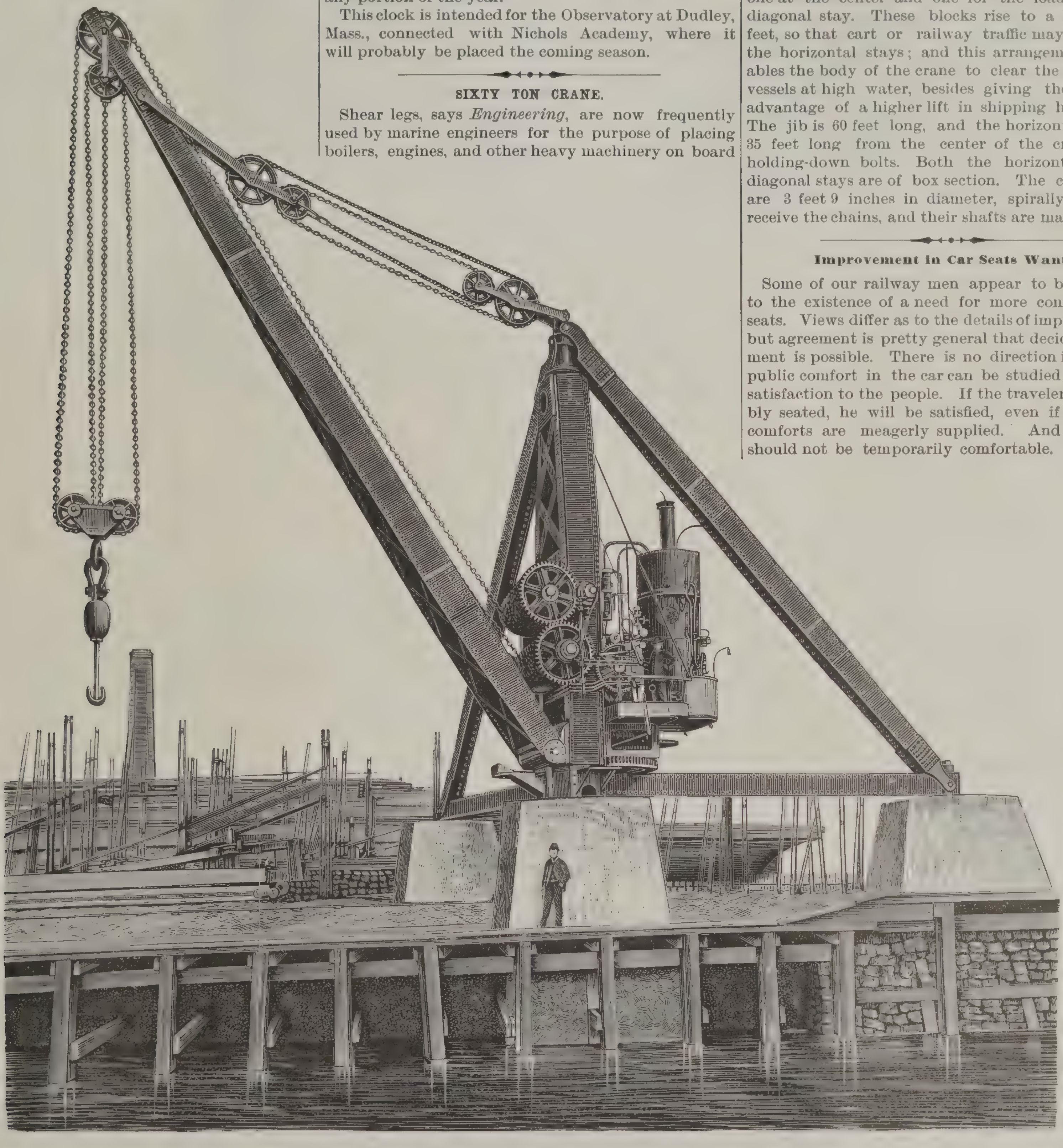
SIXTY TON CRANE.

Shear legs, says *Engineering*, are now frequently used by marine engineers for the purpose of placing boilers, engines, and other heavy machinery on board large steamers; but inasmuch as their motions are restricted to two, their usefulness is also limited. The motions referred to are hoisting or lowering and traveling outward or inward in a straight line at right angles to the wharf on which the shear legs are erected. When a boiler or piece of machinery is to be shipped, it must be brought under the lifting block. It is then raised and projected outward until it hangs directly over the vessel, which is itself then moved forward or aft, so that the object that is being dealt with may be lowered into its exact position. It will thus be seen that shear legs of themselves only cover a line, though by moving the vessel they can be made to cover an area.

Cranes having a fixed radius of jib are sometimes used for similar purposes, and such cranes have a slight advantage over shear legs, as the boilers and pieces of machinery may be deposited upon the quay or wharf under the range of the jib, ready to be lifted on board; but in this case also a line only is covered—the only difference being that it is circular instead of straight, and the vessel must be moved forward or aft when the loads are being lowered to their respective places, just in the same way as when shear legs are being used.

A crane such as we illustrate herewith is free from these defects. The jib rises and falls by power, and thus secures the covering of a large area. Boilers or other loads may be stored all round the wharf, and, by adjusting the jib radius, may be placed exactly in position on board the vessel, which remains moored, or may even be aground.

The crane now illustrated was constructed by Messrs. George Russell & Co., and has been placed on the wharf in the works of Messrs. D. J. Dunlop & Co., engineers and shipbuilders, Port Glasgow. Its working load is 60 tons, lifted at a radius of 35 feet. The foundation consists of three concrete blocks—one at the center and one for the loading of each diagonal stay. These blocks rise to a height of 14 feet, so that cart or railway traffic may pass under the horizontal stays; and this arrangement also enables the body of the crane to clear the gunwales of vessels at high water, besides giving the additional advantage of a higher lift in shipping heavy masts. The jib is 60 feet long, and the horizontal stays are 35 feet long from the center of the crane to the holding-down bolts. Both the horizontal and the diagonal stays are of box section. The chain barrels are 3 feet 9 inches in diameter, spirally grooved to receive the chains, and their shafts are made of steel.



IMPROVED SIXTY TON STEAM DERRICK CRANE.

Improvement in Car Seats Wanted.

Some of our railway men appear to be awakening to the existence of a need for more comfortable car seats. Views differ as to the details of improved forms, but agreement is pretty general that decided improvement is possible. There is no direction in which the public comfort in the car can be studied with greater satisfaction to the people. If the traveler is comfortably seated, he will be satisfied, even if some other comforts are meagerly supplied. And the seating should not be temporarily comfortable. A seat may be so constructed as to look inviting and luxuriously easy, and so as to be really easy for a while, but its lines may yet be such as make it very wearying when it is occupied for any length of time. The limitations in the way of the designer are not to be lightly dismissed. He must make his seat reversible, which fact bothers him not a little. He must be economical of space, and must study conditions of cleanliness in both the seat and the car. Cheapness of construction and strength must also not be lost sight of. But with all these it is yet not an insurmountable task to design a seat that will be very much more comfortable than the majority of those now in use, and we are glad to see that efforts are being made to obtain such a seat.—*The Railway Review.*

ONE of our contemporaries reports that Isabella, ex-Queen of Spain, is not only an owner of considerable real estate in Philadelphia, but is a shareholder in the Keely motor. From the same source we learn that the Motor Keely promises positively to mote very soon, but it begins to be believed that his mote is the much-quoted one which is all in his eye.

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CONTENTS

Of the February number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Table of Contents of

THE SCIENTIFIC AMERICAN SUPPLEMENT No. 526,

For the Week Ending January 30, 1886.

Price 10 cents. For sale at this Office and by all Newsdealers.

COUNTRY STORES AND DWELLINGS.

Our colored plates this month depict a most admirable and picturesque design, by Frederick B. White, architect, 189 Broadway, New York. The plans and the sheet of details will be of much interest, as they are carefully reduced from the working drawings.

The idea embodied in this design is somewhat unique. It is the utilization of the lower portion of a hillside dwelling as stores, the stores being entirely distinct from the dwelling portion, and entering from a street at the foot of the hill.

By this arrangement, the stores have all the advantages possible, while they in no way detract from the desirability of the dwelling portion. At the same time, the economy of the arrangement is evident, as the stores would of course bring a much higher rent than would any other utilization of the same space. The interior of the stores may be fitted up for any line of business, but in the design the one on the right is a pharmacy, the other being intended as a restaurant.

The arched way between the stores serves as a more retired place for wagons with provisions, etc., to transfer their contents through the side doors.

We will now leave the stores, and, passing around the roadway, ascend the hill.

Turning again toward the building, we find ourselves approaching a fine stone porch.

We enter, and the spacious hall with its oak paneled ceiling, hardwood floor, and tasteful mantel bids us cheerful welcome.

Looking through the half drawn portiere to the staircase hall, we catch a glimpse of the oak stairway. Passing into the parlor, we will make a tour of inspection, taking notes as we go.

The parlor is large and well lighted, opening into a snug little library, with bookcases built in across one side of the room.

The dining room is of the same dimensions as the parlor, with open fireplace, dumbwaiter connecting with kitchen above, and butler's pantry at side, from which the servants' stairs ascend. There are two bedrooms on this floor, so placed as to enter from the rear hall, opposite the dining room door, thus concealing them from the hall, parlor, and library. On the next floor there are three large bedrooms, with plenty of desirable closet room, a bathroom, and ample hall. The kitchen is placed near the servants' stairs, and is also connected by dumbwaiter with the dining room.

It will be obvious that the interior arrangement of the structure might readily be changed to suit any desired purpose.

With this description, and the accompanying plates we feel confident that the reader will concur with us when we pronounce it a happy solution of a most interesting problem of suburban architecture.

We also take this opportunity to thank Mr. White for the use of his design, as well as for aiding us in preparing our description. He is one of our most talented, successful, and experienced architects.

Durability of Building Stone.

The question of the durability of building stone is largely that of its ability to resist disintegration by frost. Various methods have been suggested for testing stone in order to settle this point. Braun recommends the immersion of the stone to be tested in a solution of some salt—such as Glauber's salt—of known strength until it becomes saturated, and then allowing the salt to crystallize in the pores of the stone. It is assumed that the effect of crystallization will be the same as that of freezing water. Tetmaier proposes the determination of a coefficient of durability to be found by observing the proportion between the resistance of the material to compression when dry and when saturated with water. Hempel suggests the comparison of the durability of stone exposed to the action of frost with its ability to resist the action of hydrochloric acid. Herr Adolph Bluemke, however, goes to the root of the matter by actually saturating stone with water, and freezing it in a suitable apparatus, according to a method described in the *Centralblatt der Bauverwaltung*. The apparatus consists of a square sheet iron box, in which the specimens of stone are placed; this box being plunged into a receptacle containing the freezing mixture. This mixture was simply ice and salt, in the proportion of 3 to 1, which produced a temperature of $+3°$ Fahr. It was found that about two hours was the time required for bringing the temperature of the specimens to that of the outside mixture. The whole apparatus, when prepared for work, was wrapped up in hair felt and sawdust, and left for the allotted time. The pieces of stone were roughly hammer-dressed into 3 inch cubes, placed in distilled water, and perfectly saturated by exhausting the air by means of a pump. After freezing for three hours, the specimens were taken out, and allowed to stand for an equal time in water, until they had completely regained the outside temperature. After remaining a short time in water, some particles would be found loosened from the less durable stones. These pieces were gently rubbed off with a soft brush, and the samples again frozen; the processes of thawing and freezing being repeated until the stone assumed the appearance of ordinary weathered stone. After the last thawing and washing, the stones were finally dried and weighed, to ascertain the loss by disintegration. In this way a comparative durability scale for the stones of any locality may be expeditiously compiled.

Navigable Balloons.

At one of the late sittings of the French Academy of Sciences, Captain Renard, the superintendent of the aeronautical workshops at Meudon, gave some very interesting particulars respecting the experiments carried out by him, in conjunction with Captain Krebs, with the navigable balloon, which, it appears, have been recently completely successful. The two experimenters have made, altogether, seven ascents, and in the final trials the balloon attained a speed of 6 meters per second, or 22 kilometers (13½ miles) per hour, so that maneuvering against the wind is now possible if the velocity of the air current is less than the above speed of the balloon. The screw of the balloon is driven by an electric motor, and makes between 2,700 and 3,000 revolutions per minute, the shaft being cooled by a stream of cold water, which prevents heating of the bearing surfaces. In reply to a question, Captain Renard stated that they preferred hydrogen gas to coal gas, because the latter possessed less buoyancy. It is intended to construct a new balloon with the means provided by the French Chamber, which is to be perfectly navigable, and to form the model for all future balloons. The mixed commission for arms and war material has also recommended to the war ministry to undertake trials with a new military balloon of not too large dimensions, which is to be made ready for ascent in less than half an hour, and may follow an army on a two-horsed carriage with all the apparatus appertaining to the balloon. From a more recent communication, it appears that the Meudon aeronauts will work the steering apparatus of the new balloon by steam, as advocated by M. Henry Giffard. Electricity is to be quite given up, on account of its want of power for continuous action.

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

The contents of the several numbers are given, in part on this page and in part on page 115.

TABLE OF CONTENTS

Of the January number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

IMPROVED PLATE BENDING MACHINE.

At the Oldfield Road Ironworks have been produced recently some good specimens of plate bending rolls, some notion of which may be obtained by a glance at the annexed illustration.

The rolls are 18 ft. 6 in. long, the distance between the standards being 19 ft. The top roll is 27 in. diameter, and the two lower ones 19 in. diameter; these latter are fluted from end to end, to secure a better grip of the plates. From the great size of the top roll (the weight being 10 tons), it will be seen that special provision must be provided for raising and lowering, otherwise too much effort would be required of the workmen. The difficulty has been met by balancing this roll by means of two large pans suspended from the end of a suitable lever underneath the framework of the machine. On the opposite ends of these levers to the pans rest the vertical rods which support the top roll.

The leverage is about 4 to 1, so that with a weight of about one ton in each pan the roll will be practically balanced. The hand gear for raising the roll is shown in the illustration. We found on trial that it was comparatively easy to lift the roll, even with the balance weights removed, but the effort would be too great to expect of a workman continuously.

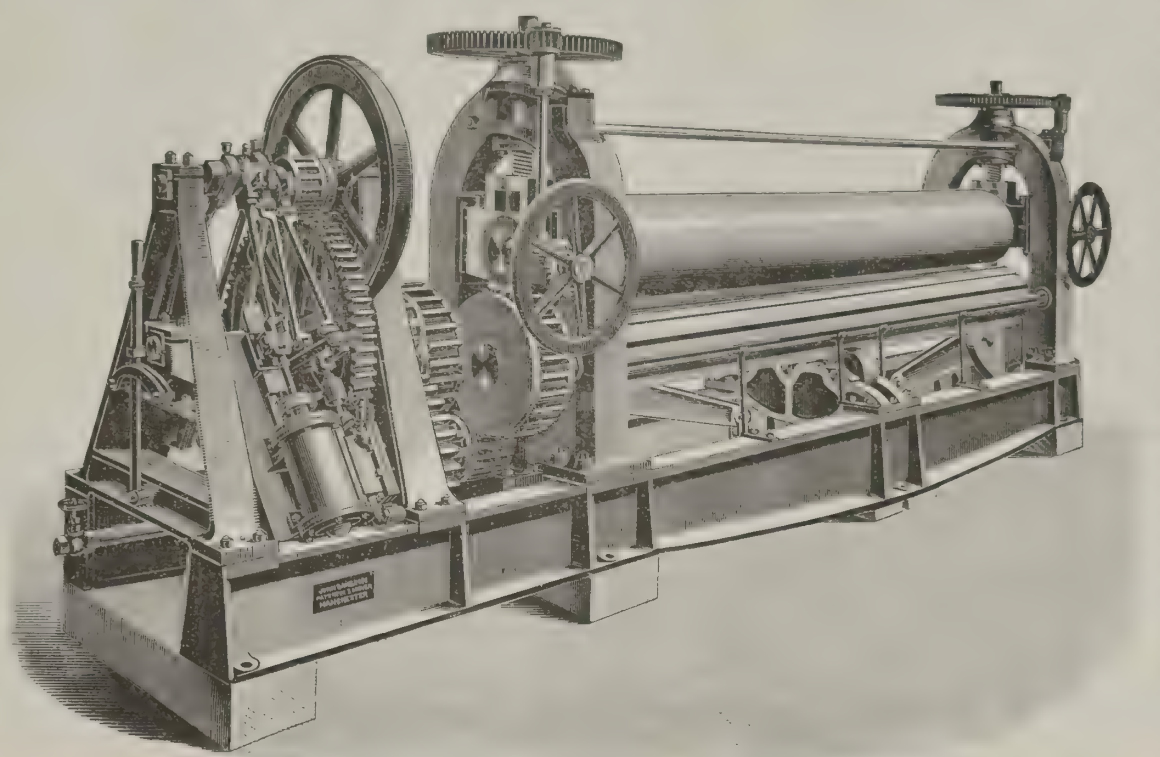
The upper roll neck is 10½ in. diameter, and the two lower ones 8½ in. A special feature of this machine is the manner of supporting the rolls in the center by means of three small friction pulleys; these are situated on a strong bridge bolted across the foundation frames of the machine, the latter being deepened in the center, as shown, to take up the strain thus brought upon them. The end frames are of box section 12 in. square, and are braced together near the top by a strong bolt in the center. We may mention that the friction rollers are 12 in. diameter and 6 in. wide, having bearings on each side 4 in. diameter and 6 in. long.

There are also provided, for the purpose of supporting the plates under operation, two strong rods running from end to end of the machine, one on each side of the lower rolls; these rods are themselves supported by four vertical brackets rising from the foundation beams, so as to prevent bending.

The bed frames are extended beyond the machine proper, as shown on the left side of the engraving, and serve as a foundation for the engine; this plan makes the machine self-contained, and much more rigid than would be the case with separate foundations for the engine and rolls.

The engine has two cylinders arranged diagonally 8 in. diameter and 10 in. stroke, with pistons runnin at a speed of 300 ft. per minute, this speed being reduced by triple gearing to a speed of nearly five revolutions per minute of the rolls, or more accurately a circumferential velocity of 24 feet per minute. The gearing is exceptionally strong, the three pairs of wheels being 2 in., 3 in., and 4 in. pitch, and 4 in., 6 in., and 8 in. wide respectively; each of the three pinions is shrouded to the top of the tooth. From the last shaft in the above series each of the lower rolls is driven through a pair of wheels of 20 and 21 teeth respectively, shrouded to the pitch line.

Both rolls are driven from the same end, so that all the gearing is located in the same place, and secures the additional advantage of not having the same amount of vibration and jerking as is experienced when the rolls are driven from opposite ends by means of a long shaft traversing the length of the machine.—*Mech. World.*



AN 18 FT. 6 IN. PLATE BENDING MACHINE.

A NEW STEAM CARRIAGE.

Street locomotion by steam has just made a great stride in the domain of practice. Hitherto, we have been accustomed to see heavy locomotives, weighing several thousand pounds, hauling carriages at a speed much less than that of the horse, and resembling road-rollers for crushing stones more than anything else. Now, Messrs. Dion, Bouton & Trepardoux have succeeded in manufacturing steam vehicles of all sorts and of all dimensions, from the tricycle up to the largest omnibuses and merchandise vans. This result is the outcome of their quick-vaporizing, circulatory, inexplosive boiler, which is applicable to all the industries in general, and which, although of slight bulk and weight, furnishes great power. Our engraving represents one of their steam phaetons—a vehicle of remarkable elegance, lightness, and strength. The frame of the apparatus is mounted upon four wheels. The two steering wheels in front are 2½ feet in diameter, and the two driving wheels 3¾ feet. Upon the frame, and in front of the driving wheels, are placed the box and two movable seats, back to back, capable of accommodating six persons. Over the driving wheels is the boiler, and, under the seat, the water tank. Behind the boiler are placed the coal bunkers, the feed apparatus, and the stoker's seat. Beneath the frame are arranged the cylinders, and the differential gear that renders the driving wheels inter- and independent. The passenger to the right has within reach the steering and reversing levers, and can therewith steer, run the carriage backward or forward, and quicken or slacken its speed. The front platform is capable of serving as a support for a trunk or any other baggage. The carriage carries sufficient water for a run of twenty-four miles and enough coal for one of sixty miles.

The waste steam is dried before making its exit into the atmosphere, and is thus absolutely colorless. The carriage is capable of turning in a curve of 6½ feet radius. The boiler, which is 2¾ feet in height, has a heating surface of 58 square feet, and weighs, with its ash-box, its chimney, and all its accessories, 880 pounds. It takes no longer than ten or fifteen minutes after firing, to get up a pressure. The production is 14 pounds of dry steam per square foot, and 8 pounds of steam per pound of fuel.

The generator is of welded boiler plate without rivets, and is capable of withstanding the strongest shocks without its tightness being affected. It is tested to 44 pounds, and registered at 26. The engine con-

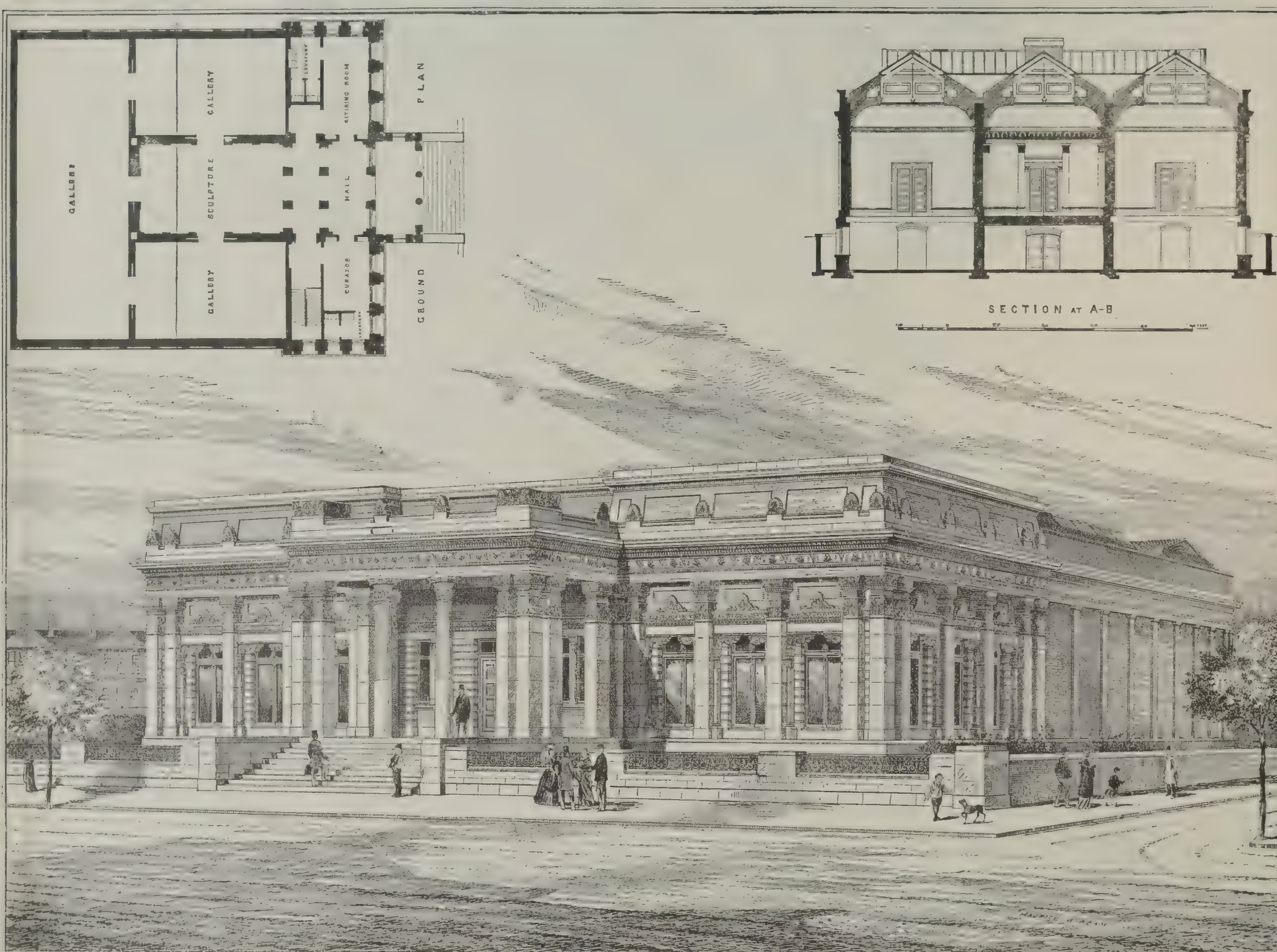
A NEW STEAM CARRIAGE.

sists of two oscillating cylinders of 4 inches diameter and 4 inches stroke, the distribution of steam in which permits of a reversal of direction and of a variable expansion. These parts are not visible, since they are inclosed in order to protect them against dust and all other causes of deterioration.

The speed of the carriage is 18 miles per hour. It is capable of ascending gradients of one-tenth at a speed of 4¾ miles per hour. The amount of fuel consumed is from 2¼ to 3¼ pounds per hour. The smokestack emits neither smoke nor steam. The exhaust steam from the cylinder makes no noise. The wheels make a little more noise than do those of other carriages, on account of the speed of the carriage, and its weight, which, in running order, with six passengers and a stoker, is 3,960 pounds.—*L'Illustration and La Nature.*

THE LAYTON ART GALLERY, MILWAUKEE, WISCONSIN.

We give a perspective view, ground plan, and transverse section of the art gallery now in course of erec-



THE LAYTON ART GALLERY, MILWAUKEE, WIS.

tion at the corner of Jefferson and Mason Streets, Milwaukee. The building is being erected at the sole expense of Mr. Fred Layton, a local art lover and successful merchant, who intends, on its completion, to present it to the city. So says the London *Building News*, to which we are indebted for our illustration. The ground or principal floor comprises three picture galleries, opening conveniently from a central apartment, and connected together by wide doors. These and the central gallery, to be devoted to statuary, are lighted by skylights of ample dimensions. On this floor are a curator's room, retiring and cloak room, and lavatories, all conveniently situated near the entrance hall. In the basement are two large rooms and an unpacking room, and extensive arrangements are provided for the heating and ventilating, a matter of the first importance in a climate such as that of Wisconsin. The exterior of the building is being constructed of the best quality of buff Amherst sandstone, straw colored Milwaukee pressed brick, and terra cotta of a similar tint manufactured by Messrs. True, Brunkhorst & Co., of Chicago. Granite, plain and polished, will be used for steps, and certain other portions liable to wear and injury. The roofing will be of tin plate, laid on terra cotta roofing plates, supported by T iron rafters. This class of covering has been found to stand best in the neighborhood of Milwaukee under all extremes of temperature. The architects engaged on the work are Messrs. W. and G. Audsley, FF.R.I.B.A., London, and Mr. E. T. Mix, of Milwaukee.

The Largest Elevator in the World.

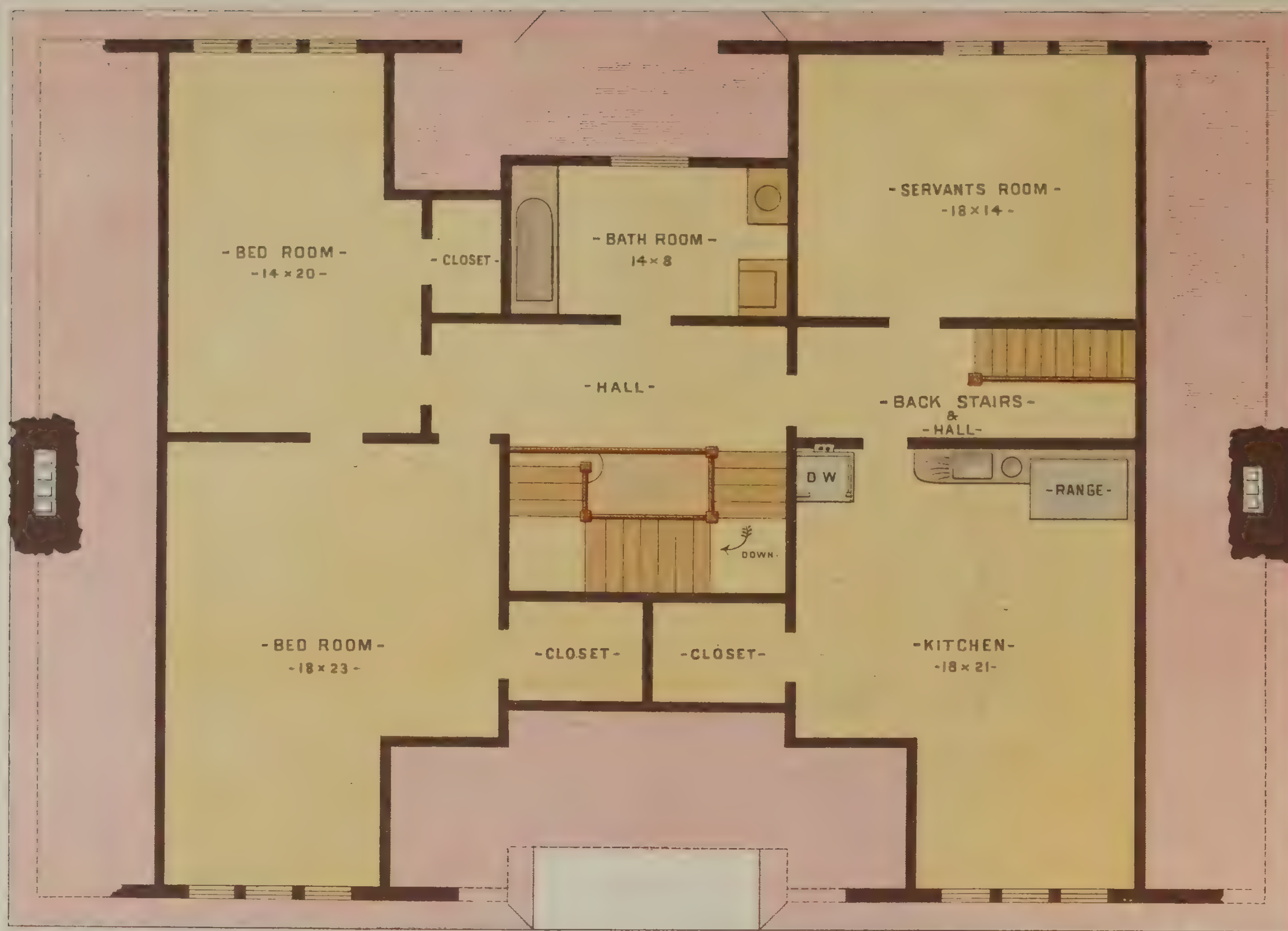
Says a Northwestern contemporary of late date: Wheat is now pouring into Minneapolis at the rate of 300 to 500 cars per day; and to those who are not acquainted with the facilities for handling the enormous quantity of grain, the problem of what becomes of it all is mysterious and interesting. The double rows of big mills alongside the falls are greedy monsters, and at this time there are daily poured down their hungry throats about 225 car loads, or 130,000 bushels, of wheat. While a portion of the wheat, on arriving from the country, is sent directly to the mills, the bulk of it has to be first stowed in the elevators to be cleaned and prepared for milling, and afterward drawn upon as occasion requires.

A description of the method of handling wheat in an elevator is interesting. The erection of the Union Elevator at Minneapolis Junction, on the Manitoba road, this year, gives to Minneapolis the distinction of possessing the largest grain elevator in the United States, and, its owners claim, the largest in the world. No other building in the city attracts so much attention as this large house, whose gray corrugated walls loom up against the clouds like a mountain. The cities of New York and Chicago have a number of groups of buildings under the name of one storehouse whose combined capacity is greater than the Union, but no other independent building in the United States equals it in size and capacity. The total cost of the building is $300,000. It is 336 feet long, 92 feet wide, and 175 feet high. Its actual storage capacity is 2,000,000 bushels. There was used in its construction 6,500,000 feet of lumber, and thirty-two car loads, or 10,000 kegs, of big nails were required to hold the planks together. Mr. Cook, the enthusiastic young foreman in charge of the building, says the actual number of nails was 13,353,900, although he declined to say that he had counted them. A giant Corliss engine, of 450 horse power, moves the machinery, and its steady strokes are almost noiseless. The elevating capacity is 175,000 bushels per day, but this can be increased to 250,000 bushels on a pinch. The proprietors say that they can handle the entire crop of Minnesota and Dakota during the season. On every floor of the building are automatic sprinklers, which deluge the place in case of fire. As an extra precaution, 800 feet of 2½ inch fire hose and eighteen fire extinguishers are stored in handy places about the building.

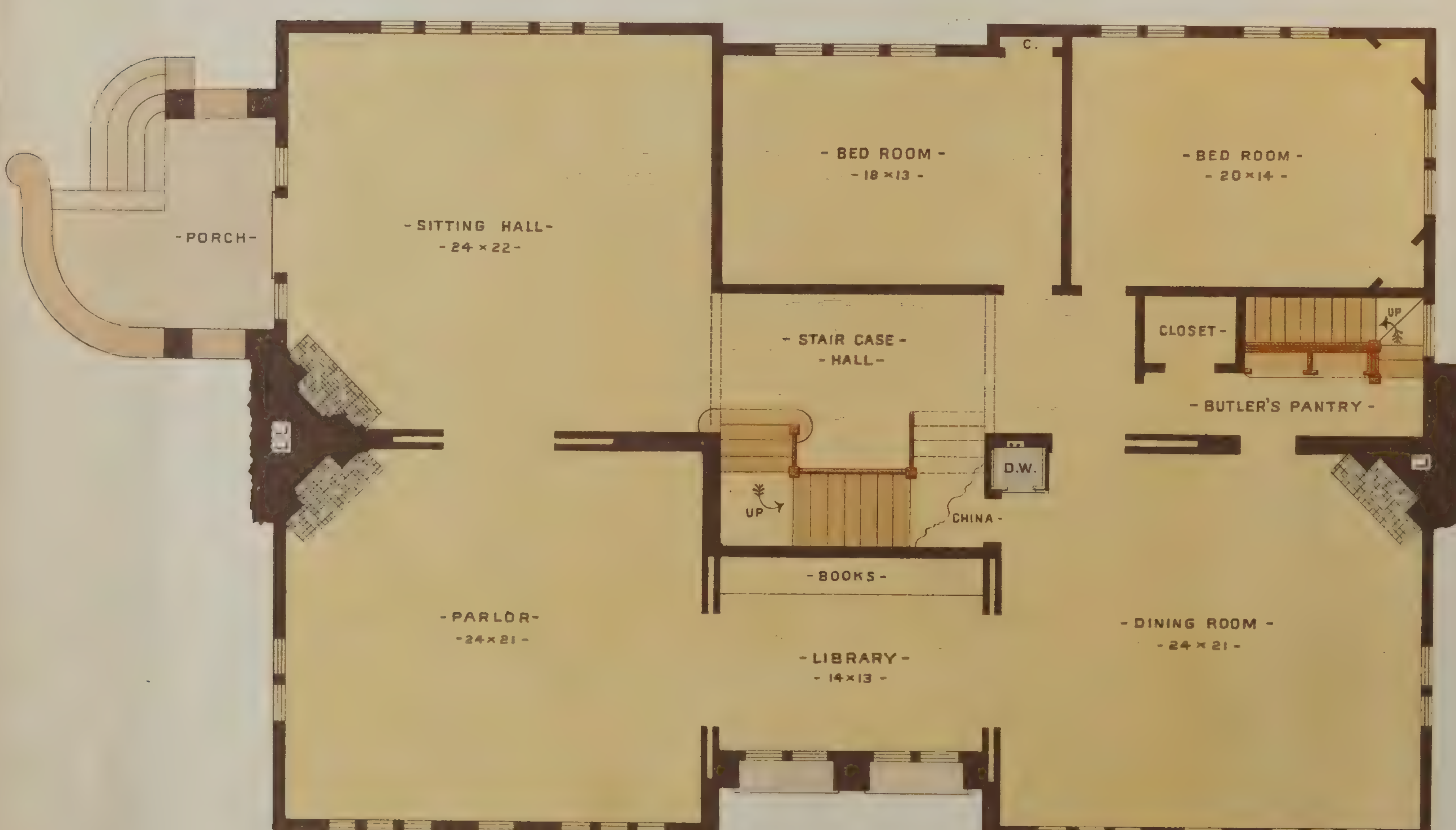
An elevator is simply a mechanical contrivance for lifting grain from the ground to the upper floor. Two railroad tracks run through the Union Elevator, and the trains of cars are taken in at one end and pushed out empty at the other. When a train arrives at the elevator, the cars are backed up to the entrance, a rope is attached, and they are drawn into the building. The doors of a car are opened, and two men with shovels as large as road scrapers drag the grain into a deep pit.

These shovels are drawn by chains worked by machinery, the men guiding them in their course from the ends of the car to the door at the side. The average time for unloading a car is five minutes, and nine cars can be emptied at one time. One hundred and forty-five cars were easily unloaded in ten hours last week, and, as the foreman remarked, "he was running only on five legs." The legs of an elevator are the long wooden boxes, or tubes, extending from the pit into which the wheat is dumped from the car to the receiving bins at the top of the elevator. Running up these legs are belts 24 inches wide, on which are fastened oblong metal cups, which catch the grain as they come up through the pit. After being carried to the top it is discharged by centrifugal force into a spout leading to the receiving bins, where it is weighed. From these bins movable spouts lead to the various storage bins, other spouts lead to the shipping bins, which hold a car load each. There are 104 of these shipping bins, and that many cars can be loaded and sent to the mills without refilling the bins. There are nine discharging spouts, and nine cars can be loaded at once, the time being about three minutes. A car load is from 500 to 560 bushels.

The Union was built by Minneapolis men under the title of the Union Elevator Company, at the solicitation of President Hill, of the Manitoba road, in order to relieve the tremendous pressure on the rolling stock of his road, and facilitate the movement of the constantly increasing crops. Ex-Governor John S. Pillsbury is president of the company, and Horace Pratt vice-president.



· Second · Floor · Plan ·



· Main Floor · Plan · of · Dwelling Above · Stores ·

· Fredk B White ·
· ARCHITECT ·
· 189 Broadway · New York ·

·COUNTRY·STORES·AND·DWELLINGS·

·FRED^K^·B·WHITE·ARCHITECT·NEW YORK·

The Chinch Bug.

In a late number of the SCIENTIFIC AMERICAN was a short article saying that the chinch bug had made its appearance in Eastern grain fields, and in such numbers as to excite alarm. The cause for alarm is well founded if the pest named has showed itself, for Western farmers have had but few enemies so destructive and difficult to contend with as the chinch bug. When it works at all, it works so rapidly and in such myriads that but little effective opposition can be made. Wheat is the grain which suffers first, as a general rule; but when the conditions are favorable to the pest, it is liable to extend its ravages to all other grains, not excepting corn. More than once have I seen a fair sized piece of corn wholly ruined by the chinch bug. In such cases the stalks to the height of a foot and a half, or more, would look as if they had been flooded with muddy water which had left its filth behind on retiring. All the sap channels of the stalk would be cut through, leaving the grain and beans to wither away in absolute worthlessness. The bug only thrives in dry, hot weather; a wet season is one in which it can do no harm. Any means which can keep the ground about the grain roots cool and damp operates to check its ravages. Many have saved their wheat by sowing clover with it. Salt is thought by some to have a good effect from its tendency to attract moisture. Barley and rye generally get out of the way before the weather is hot enough to bring out the bug in full force; the outcrop is so dense and moist as usually to escape unharmed. A thin crop of spring wheat on a lumpy soil is the bug's delight on a hot July or August day. The bugs winter among the refuse of fence corners, and decaying logs and brush, and find good conditions in a field well covered with stalks and lumps of earth. The clearing up of such refuse and the rolling of the ground so as to leave a smooth surface have a preventive effect. The location of a nest of bugs can often be determined by the whitened heads of the grain in a particular part of the field. It is a good plan to try at once and destroy the nest, which can usually be done by stamping and pounding the ground down hard. Fire has but little effect on the bugs, that is, such fire as burning straw over them would make; they are more afraid of water. Some of our farmers have protected their fields quite effectively from outside invasion by sowing Hungarian grass around the outer edge of the field, for about a rod in width. C.

CONSTRUCTING, VENTILATING, AND COOLING CELLARS.

A current of cool air is caused to pass from the earth, stones, or gravel outside of the cellar walls through the cellar upward or outward into the open air. By means of tubes open at each end and extending through the walls, the air is obtained from the earth, where it naturally exists wherever the soil is porous, light, or sandy. The ends of the tubes toward the earth may bear either directly against the earth, so as to appear to be stopped up, or, as is preferable where the nature of the soil will admit, they may be inserted in holes bored in the earth a short distance, or, when that is not practicable, the earth may be removed from the immediate vicinity of the ends. By the last two methods there will be less danger of the tubes stopping up with earth and thereby lessening the draught of air thus obtained.

The filling of the tubes with porous soil will not destroy the draught of air, but may to some degree impede it. When the cellar walls are surrounded by a heavy clay soil, a well may be made outside of and adjoining the walls; this well should extend parallel with the wall, and may, if necessary, go entirely around the walls. The object of the shaft in clay soil is to afford a receptacle for sand, gravel, stones, or porous earth, from which the cool air is to come by means of the tubes through the cellar walls. Instead of tubes, openings of any sort may be made in the walls, but terra cotta tubes are preferable. The tubes may, if advisable, be inserted in the bottom of the cellar through the impacted earth of the floor down into the looser and more porous earth below.

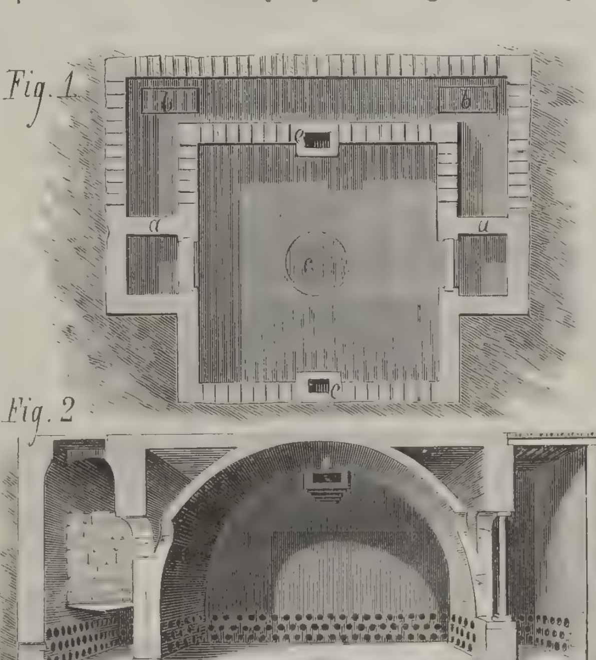
This plan is also applicable to beer and other cellars where ice is used in hollow walls around the cellar to keep it cool. In such cellars the air is first taken from the earth in the manner described, and passed by tubes or openings into a vault or cell made cold by ice; then it is passed by another set of tubes into the interior of the main cellar, so that the air obtained from the earth is made cooler by being drawn through the ice cell. The ice rests upon a grating just above the currents of cool air. In beer cellars, where it is necessary to have an extraordinary amount of air and a rapid draught—greater than can be obtained from the earth, because it is not porous enough—a shaft is dug outside the ice cell and filled with coarse material. Tubes extend into the outside earth. Openings from the interior of the cellar to the external atmosphere are essential to produce a draught of air from the earth.

In the accompanying engraving Fig. 1 is a ground plan of a cellar, and Fig. 2 a view showing the interior. Along the bottom of the walls are shown the rows of tubes through which the air passes from the exterior; *b b* are trap doors; at *e* are openings leading to the outer air, and at *c* is an air well built in the center of the cellar floor. Just in front of the walls, *a*, are areas, and behind one wall is a mass of ice, shown in the left of Fig. 2.

This invention has been patented by Mr. Joseph K. Frick, of Evansville, Ind. For particulars address John Raum, Washington, D. C. (see Business and Personal column).

Fig. 1

Fig. 2

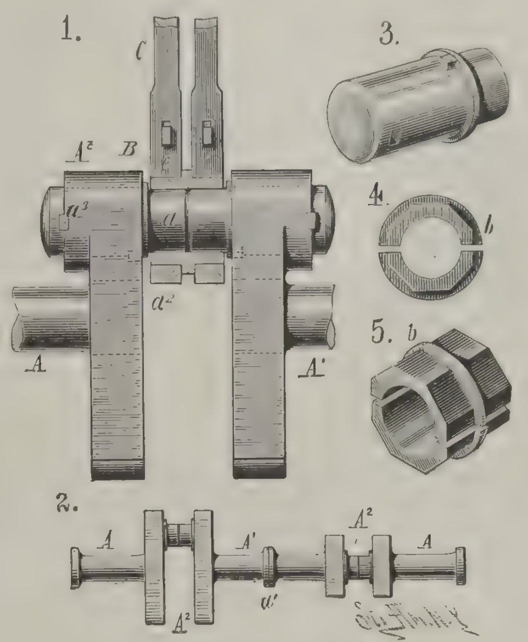


FRICK'S CELLARS.

CRANK PIN FOR STEAM ENGINES.

Too frequently we hear of ocean steamers being disabled by reason of a broken crank pin, crank, or crank shaft, and during the time occupied in repairing the damage the safety of the vessel is endangered. The object of the invention illustrated by the accompanying engravings is to provide simple and effective means for obviating the liability to breakage of crank pins in the crank shafts of steam and other engines, and for facilitating and economizing repairs, especially in the case of marine engines, either at sea or in port.

The crank pin (Fig. 3 is a perspective view of one section of a divided crank pin) is either forged in or subsequently divided transversely in two separate sections, each of which



EDDOWES' CRANK PIN.

has a cylindrical bearing surface at one of its ends for a distance equal to about one-half the length of the bearing surface of an ordinary crank pin, and a body of proper diameter to fit within the eye of the crank arm, A^2. In order to stiffen the sections, a collar, a^2, which may either abut against the face of the crank or enter a recess, is formed upon each section of the pin between its bearing surface and body. The outer end of the bearing surface is curved at its periphery, so that when the two sections are brought into line a small circumferential groove will be formed, which serves to give proper clearance to the brasses and also retain the lubricating substance.

The crank pins may be secured to the arms by being shrunk in in the ordinary way, but for greater facility of insertion and removal the inventor prefers to effect the connection as follows: The eyes of the cranks are bored out with a very slight taper, and the body of the pin is correspondingly turned so as to insure a good, snug, and moderately hard driving fit entirely through. A feather (shown in Fig 3), formed upon the body of the pin at the face of the crank arm next the bearing surface, fits into a recess in the arm, serving to resist turning or twisting strain upon the pin. To further secure the pin, a key, a', is passed through a transverse slot in the body of the pin, the key fitting at its ends in keyways in the face of the crank eye. The key is carefully and snugly fitted, and should have a very slight draught to keep it safely in place. It may also have an adjustable keeper, secured by a top bolt and jam nut in the usual manner.

The crank pin box, of which Fig. 4 is an end view and Fig. 5 a perspective, is divided longitudinally into halves, each one of which may be in a single piece or be divided transversely into two sections, each fitting the bearing surface of one section of the pin, as in Fig. 1. In either case, to afford additional strength to the brass, a collar is formed upon each of its halves, extending around the periphery of the brass exterior to the plane of contact of the abutting ends of the crank pin sections. The collar may be accommodated either by forking the end of the connecting rod or by dividing the rod longitudinally into two parts, as in Fig. 1, each portion being fitted with a separate stub end to embrace the brasses of the adjacent crank pin section, and being coupled at its opposite ends to the cross head. In such case a slight degree of circumferential movement will be permitted between the two crank pin sections, thereby tending to relieve the box from strains induced by variations in the alignment of the crank shaft sections to which the arms are respectively attached. Fig. 2 is a side view, in elevation, of a crank shaft embodying this device, and Fig. 1 is a similar view, showing a pair of crank arms with the crank pin box in position and illustrating the method of securing the crank pin sections by keys and feathers.

In addition to the advantages already enumerated, this method admits of any desired section of the crank shaft being easily and quickly raised whenever desired, to afford access to the bottom brasses of the main journals, and enables a section of a shaft to be readily removed, if broken, and replaced by a spare section without disturbing the remaining portions of the shaft.

Further information regarding this invention may be obtained from the patentee, Mr. A. K. Eddowes, whose address is care Agent Pacific Mail S. S. Company, San Francisco, Cal., or from Mr. J. Snowden Bell, Pittsburg, Penn.

American Gems and Precious Stones.

Mr. George F. Kunz has contributed to "The Mineral Resources of the United States," published by the Government, an article on American gems and precious stones, of which separate copies have been printed. Mr. Kunz has for some years been connected with Messrs. Tiffany & Co., the well known jewelers of New York city, and has had an excellent opportunity for collecting facts concerning American gems.

He states that systematic mining for gems and precious stones is being carried on at only two places in the United States, viz., Paris, Maine, and Stony Point, North Carolina. In other cases where gems are found they are either met with accidentally, or occur in connection with other materials that are being mined or in small veins which are only occasionally met with. They are often gathered with little system on the surface, as is the case with the sapphire, garnet, and olivine found in Montana and New Mexico; or from the beds of streams and decomposing rock, as the moss agate from Colorado; or on beaches, as the agate, chlorastrolite, and thomsonite from Lake Superior.

Some eighty-eight different minerals occur in the United States which have been used as gems. Twelve of these occur in the United States only.

Diamonds are not mined in this country, although they have occasionally been found at a number of localities. A large diamond was found at Manchester, opposite Richmond, Va., by a laborer employed in grading one of the streets. It was an octahedron, and weighed, after it was cut, over ten carats. It was worth $5,000 before cutting. The principal localities for sapphires and rubies are in New Mexico, Arizona, and Southern Colorado, where they occur in the sand, often on ant hills. Garnets occur in the same region, about $5,000 worth of cut stones being annually produced. It is estimated that the value of the tourmalines taken from Mt. Mica, Maine, is between $50,000 and $65,000. Tourmaline and hiddenite are being regularly mined at Stony Point, N. C., some $7,500 worth having already been sold. Rock crystal is gathered and cut in large quantities, the sales at different localities probably amounting to $40,000 annually. Much of it is cut for jewelry, as "Lake George" or "Cape May" "diamonds." The clear crystal for optical purposes is almost entirely Brazilian, as the good material found here rarely reaches the proper channels. Although agates are abundant here, nearly all the polished specimens sold in America have been polished in Germany, having originally come from Brazil and Uruguay. Moss agates, however, are collected here in large quantities, although the cutting is done abroad. The sunstone and moonstone, from Pennsylvania and Virginia, is of good quality, although as yet used but little. The American turquoise is of much interest, but is not much used by jewelers. It is frequently blue when found, but soon turns green on exposure. Jet occurs in Colorado and Texas, and will probably soon be utilized in the arts. The bowenite of Rhode Island and the williamsite of Pennsylvania are used as a substitute for jade.

Cleaning Out Waste Pipes.

The annoyance arising from the stoppage of waste pipes in country houses, although very great, is but a small matter compared with the dangers which may follow obstructed pipes. The "sewer gas," about which so much has been written and which is so justly dreaded, is not, as many suppose, the exclusive product of the sewer. Indeed, the foulest, most dangerous, and deadly gases are not found in the sewers themselves, but in the unventilated waste pipes and those which are in process of being clogged by the foul matters passing through them. Any obstructions in the soil or waste pipes are therefore doubly dangerous, because it may produce an inflow of foul gas into the pipe, even though the entrance to the sewer itself has been entirely cut off.

The question is how to get rid of the accumulations in pipes partly stopped or already closed. Digging up and cleaning out is a costly remedy, often ineffectual by reason of careless workmen. The second is the plumber's force pump, which is usually only a temporary relief. In pipes leading from the house to the cesspool there is a constant accumulation of grease. This enters as a liquid and hardens as the water cools, and is deposited on the bottom and sides of the pipes. As these accumulations increase, the waterway is gradually contracted, till the pipe is closed.

When the pipe is entirely stopped, or allows the water to flow away by drops only, proceed thus: Empty the pipe down to the trap, or as far as practicable, by "mopping up" with a cloth. If water flows very slowly, begin when the pipe has at last emptied itself. Fill the pipe up with potash, crowding it in with a stick. Then pour hot water upon it in a small stream, stopping as soon as the pipe appears to be filled. As the potash dissolves and disappears, add more water. At night a little heap of potash may be placed over the hole, and water enough poured on so that a supply of strong lye will flow into the pipe during the night. Pipes that have been stopped for months may be cleaned out by this method, though it may call for three or four pounds of potash. The crudest kind, however, appears to act as well as the best. If the pipe is partially obstructed, a lump of crude potash should be placed where water will drip slowly upon it and so reach the pipe. It is also well to fill the upper part of the pipe with the potash as before, and allow hot water to trickle upon it. Soda and potash are both used for the purpose of removing greasy obstructions, and the usual method of application is to form a strong lye and pour it into the pipe. It is better to put the potash into the pipe, because the water which it contains, instead of diluting, helps to form the lye. As water comes in contact with the potash it becomes hot, thus aiding in dissolving the grease. Potash, in combination with grease, forms a "soft" or liquid soap, which easily flows away, while the soda makes a hard soap, which, if not dissolved in water, would in itself obstruct the pipe.

When a pipe is once fairly cleaned out, the potash should be used from time to time, in order to dissolve the greasy deposits as they form, and carry them forward to the cesspool or sewer. The potash is very valuable for this purpose, because, in addition to its grease-solving powers, it is exceedingly destructive to all animal and most vegetable matters. The most dangerous and deadly gases appear to come from urinals and wash-basin pipes, these, in many cases, seeming to be more foul than those from water closets. The decay of the soap and animal matter washed from the skin appears to be the sources of the gases. The potash will be effective in keeping these pipes clear, and in this way may lessen the dangers.—*A correspondent in the American Artisan.*

A Method for the Purification of Commercial Carmine.

BY JOHN S. ADRIANCE, A.B., F.C.S.

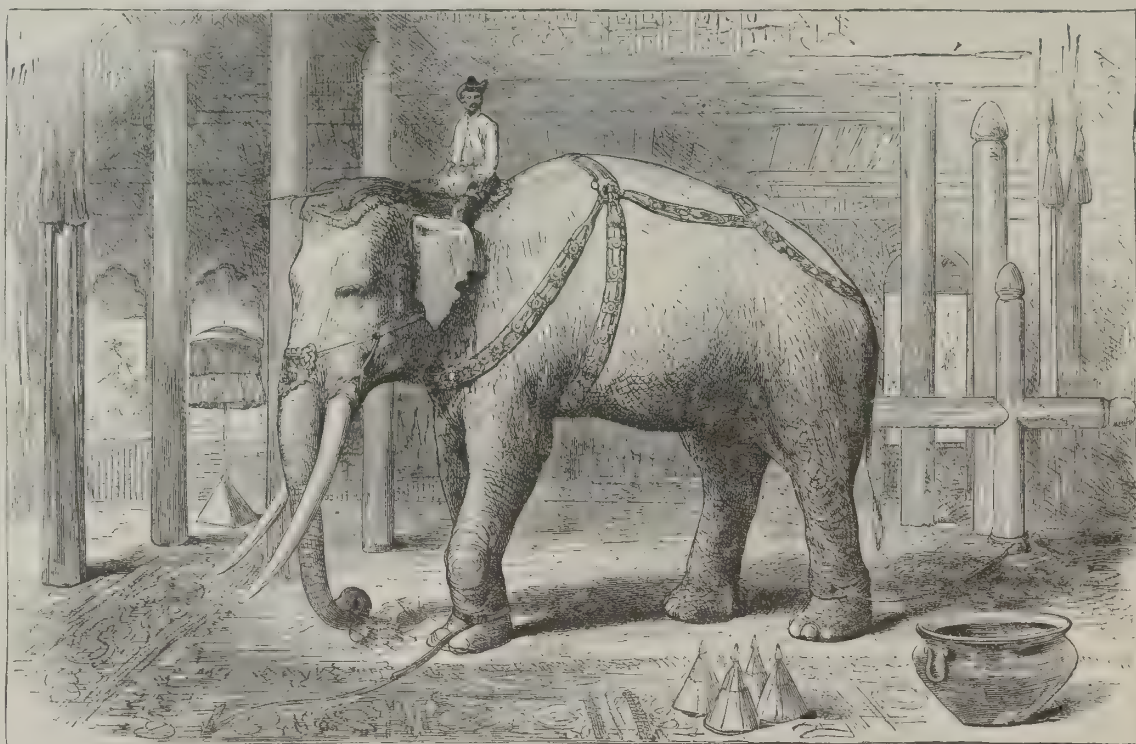
Of all substances used for staining in histological work, carmine is perhaps the most important, but the impure state in which it is sold prevents entire dependence being placed upon it. Commercial carmine contains many impurities and adulterations, more especially fatty matter, tyrosine, talc, carbonate of lead, vermilion, and dust. Pure carminic acid, which is the basis of carmine, is easily soluble in water and alcohol. This is taken advantage of in its purification; very often three-quarters of the commercial article is worthless for coloring. The following method may be found of service:

Extract the carmine with boiling water, washing the residue several times; treat the liquid with lead acetate acidulated with acetic acid until a drop of the solution is colored by hydric sulphide (H_2S). Wash the precipitate by decanting twice, then bring on a filter, decompose with sulphuric acid (H_2SO_4), and filter; repeat this last operation twice, the second time using hydric sulphide (H_2S) instead of sulphuric acid (H_2SO_4). Evaporate to dryness on a water bath, as the acid is decomposed at 136° C., wash with absolute alcohol, and filter; allow the alcohol to evaporate spontaneously, when crystals will be distinctly seen; wash with warm water, filter, and evaporate to dryness over a water bath. Dissolve the residue in ether, and allow the ether to evaporate spontaneously, when crystals of pure carminic acid will appear. Preserve for use in glass stoppered bottles. If your work has been accurate, an alkaline solution of iodine will entirely destroy the color.

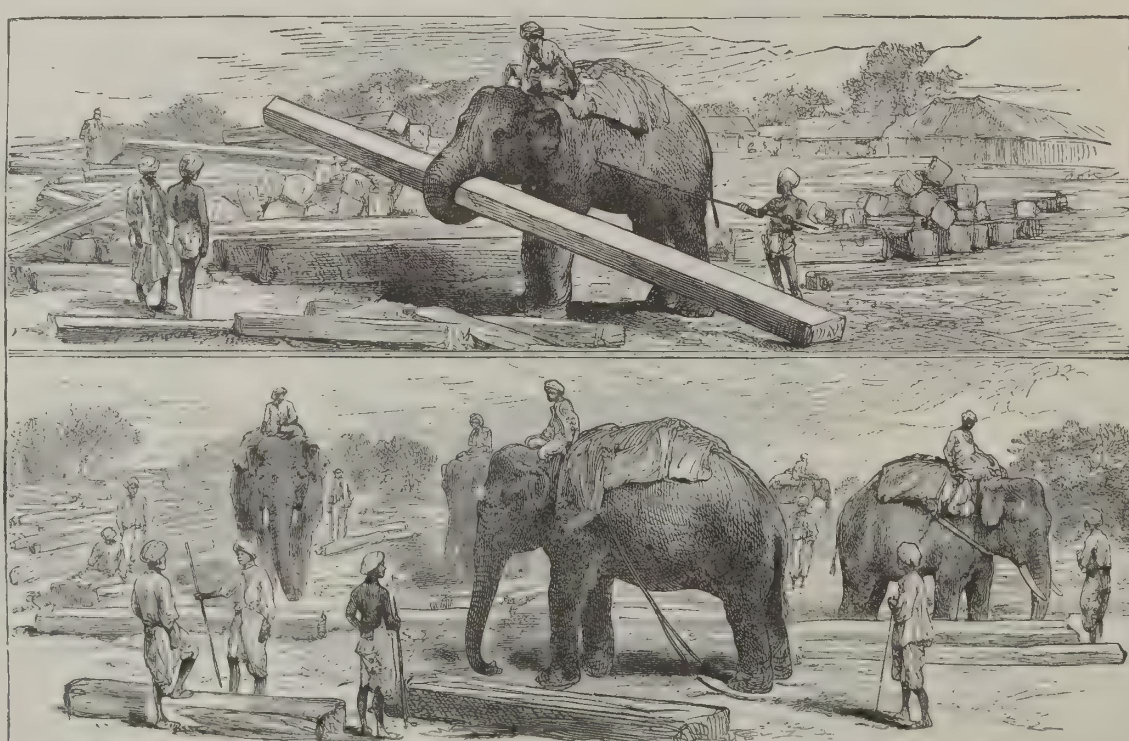
BURMAH.

The English possessions in India have lately been augmented by the annexation of the territory of Upper Burmah. The King, Theebaw, managed to get into a dispute with the English, who hold lower Burmah, or that portion bordering on the Indian Ocean, including Rangoon and the mouth of the Irrawaddy River. The result was, the English sent a military force up the river on steamers, and the capital of Upper Burmah, Mandalay, including the King, was soon captured. Burmah is a great place for elephants.

We present illustrations from the *Illustrated London News* of the King's "sacred white elephant" and the employment of working elephants in the removal of teak, which valuable kind of timber, superior to oak for ship building, is one of the most important products of Burmah. It is sent down the river from the forests beyond the British frontier to Rangoon and Moulmein, whence it is mostly exported to British India; and the recent dispute between King Theebaw and the British Commercial Company in his dominions had reference to the cutting of teak.



THE SACRED ELEPHANT OF BURMAH.



ELEPHANTS CARRYING TEAK TIMBER—BURMAH.

Mandalay, the royal city and capital of Upper Burmah, with a population of 100,000, situated on the left bank of the Irrawaddy, is 350 miles above Rangoon. The city and sheltered suburbs measure four miles square. The city is three miles from the banks of the river, and is entirely commanded by the hill, on the top of which is the pagoda. The city proper is within a broad moat, on which King Theebaw had two state barges, and there are five bridges across it. Next to the moat is a high brick loopholed wall, one mile square, on which are forty-eight pagodas, and which is backed by an earth embankment to within six feet of the top. In the center of the city is the palace, occupying a space of a quarter of a mile square, and surrounded by a high stockade and inner wall, with four entrances, and another inner stockade and wall. In the palace yard are the late King's tomb, the Mint, High Court, Tower, with bell and drum, and the celestial elephant. All the buildings, including the palace itself, but excluding the Mint, are gilded, and are of wood or bamboo.

The Treatment of Frost-bitten Fingers and Toes.

Dr. Lapatin, in the *Proceedings of the Caucasian Medical Society*, advises that fingers and toes which have been slightly frost-bitten, and which subsequently suffer from burning, itching, and pricking sensations, should be painted, at first once, and afterward twice a day, with a mixture of dilute nitric acid and peppermint water in equal proportions. After this application has been made for three or four days, the skin becomes darkened and the epidermis is shed, healthy skin appearing under it. The cure is effected in from ten to fourteen days. The author has found this plan very effectual among soldiers, who were unable to wear their boots in consequence of having had frozen feet. They were, in this way, soon rendered capable of returning to duty.—*British Medical Journal.*

THE Rothschilds, it is said, invested 800,000 francs in the experiments of M. Marcel Duprez for transmitting power over long distances by means of electricity. The motive force is conveyed by a comparatively feeble current, thereby doing away with the apprehension of dangerous friction and resistance. Niagara Falls may yet be utilized to operate engines in New York or Philadelphia by electricity.

Railway Electric Lights.

An interesting experiment is now being tried on the Metropolitan District Railway, London, in connection with one of the suburban trains running from High Street, Kensington, to Putney, the carriages of which are lighted by electricity direct. In carrying this out, a Siemens dynamo and a Willans three-cylinder engine are placed in a luggage van which is attached to the train. Steam is supplied to the engine by means of a small boiler, which is also fixed in the van. The carriages are lighted by means of a total of twenty-eight Swan incandescent lamps of 20 candle power each, which give a very brilliant light. The present machinery was designed for a longer train, and, in addition to the lamps in the carriages, there are about thirty in the van which are always lighted when the others are. The object of this is to ascertain the exact cost of working a sufficient number of lights for the longer trains, which are usually fitted with fifty ordinary gas lamps. The experiment is being carried out for Lord S. Cecil, general manager of the District Railway, and Mr. J. S. Forbes, chairman of the London, Chatham, and Dover Railway Company. The first public trial of the light took place recently, and the results were considered very satisfactory. It is, therefore, intended to continue the experiment for some weeks, the train being all the time in regular work. In the event of the machinery proving effective and trustworthy, it is probable that a Willans engine and a dynamo will be placed on the engine of the train, so that steam can be supplied from the locomotive boiler. This arrangement, which has been proposed by Mr. W. F. Massey, of Twyford, will necessarily prove cheaper, inasmuch as the small boiler and the special attendant in the van will not be required. It is anticipated that the cost of lighting a train by electricity direct will be much less than that of oil lamps.

Enameling Cast Iron Ware.

Otto Holrenz, of Beresdorf, has devised a new process for preparing iron vessels for enameling. He sets out with the assertion that the enamel adheres to the white iron better than to gray, because the latter contains a mixture of uncombined carbon (graphite); hence, the articles to be enameled should be cast in iron, the surfaces of which are free from graphite. To accomplish this the mould in which the iron is cast is made of damp sand covered with a substance that will take up carbon and remove it. The best substance for this purpose is sulphur, which combines with the free graphite to form sulphide of carbon, which burns as soon as formed. Holrenz, therefore, dusts the moulds with fine sulphur powder, either alone or mixed with pulverized quartz or charcoal dust. The mixture contains more or less sulphur according to the quality of the iron used, but always has enough sulphur to convert the surface of the iron in contact with the mould into white iron.

The castings thus prepared are not pickled, as was previously customary before enameling, but the first or basic coating is applied directly to iron as soon as it has been mechanically cleaned or scoured.

A similar result is obtained by coating the mould with oil or petroleum, whereby a portion of the graphite is converted into a hydrocarbon, and this burns up when the casting is made.

Finally, to remove the graphite from the surface of an article already cast, it is coated with sulphuric acid of 60° B. and then ignited, when sulphuric acid that has penetrated into its pores acts upon the graphite as the sulphur powder in the mould does upon the fluid iron.—*Deut. Industrie Zeitung.*

Artificial Diamonds.

The importation of artificial gems, in which there has always been a large trade, has lately been greater than usual, a new French imitation diamond having proved quite popular. It is made of strass, a variety of flint glass containing more lead and in some cases a smaller proportion of borax, but the glass is subjected to a great heat and then plunged into cold water, whereby it is contracted so the grain becomes very close and fine. It is cut and polished like a real diamond, a leaden wheel with oil and diamond dust being used.

These artificial diamonds are called "heliolas," and are graded to conform to carat sizes of real diamonds, selling at from $20 to $50 per gross. A very small bit of foil is used as a backing, attached to the center of the back, reflecting the light into the heart of the stone. Such imitation "diamonds" are largely used for theatrical and fancy dress purposes, and in rolled plate jewelry of every form, besides being sometimes worn, it is said, by ladies owning real diamonds, and others whose financial condition has compelled them to part with their real gems. It requires the skill of an expert to determine the difference between the genuine stone and the new imitation.

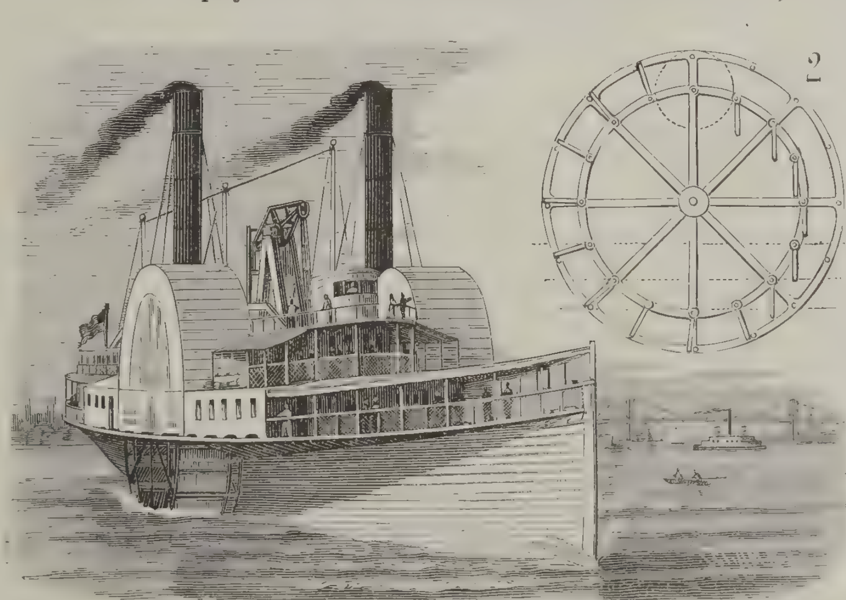
A RECENT French law makes revaccination incumbent upon every student received into the lyceums and colleges. Since the experiment was made at the Lycee Louis le Grand not a single case of variola or varioloid has appeared.

THE DUPLEX TIDE WHEEL.

The wheel shown in our first engraving will work with equal efficiency in both directions. The plan is simple, and permits all the parts to be easily and yet strongly and durably constructed. It consists of a rigid outer wheel and a loose inner wheel provided with stops, to limit its movement, and with hinged paddles held to their work by the connecting rods of the outer wheel. To the shaft are rigidly attached the side frames of the outer wheel, the rims of which are connected by as many rods as there are paddles. Upon the shaft, at the inner side of these frames, are placed the

THE DUPLEX TIDE WHEEL.

side frames of the inner wheel, the rims of which are connected by rods, and which are kept at the proper distance apart upon the shaft by collars united by bars or by a tubular washer. The inner wheel moves freely upon the shaft, but its movement is limited by blocks (shown in Fig. 2) attached to the rims of the frames of the rigid wheel, and which engage with the spokes of the inner wheel. To the connecting rods of the inner wheel, which is made smaller than the other, are hinged the inner edges of the paddles, which project between the rods of the outer wheel. From this it will be readily seen that the wheel will work equally well in either direction, the only lost motion being the distance the stop has to travel between the adjoining frames when the current is reversed.



THE ACME PADDLE WHEEL.

THE ACME PADDLE WHEEL.

Our second engraving represents a feathering paddle wheel, in which the blades are pivoted at their inner edges to the frame, and are held to their work by stops placed in the frame radially beyond the pivots, thus leaving the blades free to revolve in a full circle as shown in the sectional drawing. By this arrangement, when the wheel is revolved in either direction the paddle will revolve in the opposite direction until it is immersed, when it will be pushed through the water by the bars, thereby propelling the vessel in the opposite direction. With slow motion the paddles will dip edgewise into the water, as indicated in Fig. 2; with extreme speed the centrifugal force will carry them outward in a straight line from the shaft. In this case they meet a countercurrent nearly equal in velocity to that of the outer rim of the wheel, and will then feather to this current until acted upon by the bars. By reversing the motion the paddles will arrange themselves to their work in the opposite direction in one-half a revolution of the wheel. The wheel may be immersed in the water nearly to the main shaft and yet it will retain its propelling power, and for this reason it is adapted for seagoing as well as river and coast steamers. In Fig. 2 the dotted line shows the path which the paddle is free to traverse. Instead of one line of paddles there may be two or three arranged upon pivots in concentric circles. The inventor has found by experiments that this wheel is greatly superior to the ordinary rigid paddle wheel.

These inventions have been recently patented by Mr. C. L. Petersen, whose address is P. O. Box 2705, Boston, Mass. Patents applied for in England, France, Germany, and Canada.

Steel Spring Motors.

At a recent meeting of the Engineers' Club of Philadelphia, Mr. Wilfred Lewis read a paper upon the "Resilience of Steel," reviewing some of the means employed for the storage of energy, and showing the place occupied by steel among them.

Among the means now employed, compressed air, hot water, and the storage battery were cited from an English writer as being about equal in value, and as giving out about 6,500 ft. lb. of work per pound of material used.

Steel springs, according to the same writer, were said to yield about 18 ft. lb. per pound. In this connection the project of using steel springs as a motor for street cars was referred to as the most hopeless of all possible means of locomotion.

To test the accuracy of this statement in regard to steel, several experiments were made by the writer upon tempered specimens, both for tension and flexure. Contrary to expectation, the highest results were shown by the flexure of a small spiral clock spring weighing 2,040 grains, which gave out, when wound up, about 45 ft. lb. of energy, or in other words, 154 ft. lb. per pound.

The transverse strength of this steel within the elastic limit was found to be about 300,000 lb. per square inch, and its modulus of elasticity about 30,000,000. Such extraordinary strength, with such a low modulus, was so far beyond conjecture that it seemed to give a new hope for the success of the project referred to; but after making the necessary allowances for weight of car and efficiency of driving mechanism, it was found that not more than about 20 ft. lb. per pound of car would be available for locomotion. It was therefore improbable that such a car could ascend a hill over 20 feet high.

It was also a matter of doubt whether larger springs could be made to show results which would even approach these figures, and on this account the experiments about to be tried might be looked for with some interest.

Indian Fish-Egg Food.

We are indebted to Messrs. Fulda Brothers, of San Francisco, for a fine specimen of the fish-egg food prepared by the native Indians of British Columbia. The specimen received consists of a small branch of cedar, the leaves of which are thickly coated with dried fish eggs. Our correspondent says the eggs of the specimen sent are from a small fish that abounds in the waters of Vancouver's Sound, and are collected by making a mattress of cedar twigs and sinking them in shallow places until the fish have deposited their spawn, when the twigs are raised and the spawn allowed to dry. When wanted for use, they are simply soaked and eaten.

In this connection we will give the following item from a correspondent of the Chicago *Tribune*, who tells about fish and fishing in Sitka Bay, Alaska:

Drop a hook in any of these immense stretches of inland waters, and especially amid the Alexandrine Archipelago, and in a moment a fish will be at the bait. Rock cod, halibut, weighing from 40 to 150 pounds, salmon, fill all the streams and bays; and the herring! A fish story here will be apropos. During the spring of 1881 the writer was in Sitka, and was a witness to one of the most wonderful sights in the bay of Sitka. For more than a week the water of the bay, covering an area of fifteen or twenty square miles, was as white as milk with fish spawn, extending as far as the eye could see. The herring were so numerous that people were gathering them from the water along the beach with their hands and filling baskets with them. The Indians placed spruce boughs in the water, and when these were taken out not a particle of the original green but what was covered with a thick coating of eggs. An Indian in a canoe, with a stick about seven feet long, and for a distance of about two feet studded with nails, points outward, plied the water with this crude implement, each dip in the water bringing up from two to seven fish, and filling his canoe in somewhat less than forty-five minutes.

Eatables on Ocean Steamers.

Few persons are aware of the extensive nature of the victualing on board the great ocean steamers. Such a vessel is provisioned as follows for the passengers and crew: 3,500 lb. of butter, 3,000 hams, 1,600 lb. of biscuits, exclusive of those supplied for the crew, 8,000 lb. of grapes, almonds, figs, and other dessert fruits; 1,500 lb. of jams and jellies; tinned meats, 6,000 lb.; dried beans, 3,000 lb.; rice, 3,000 lb.; onions, 5,000 lb.; potatoes, 40 tons; flour, 300 barrels; and eggs, 1,200 dozen. Fresh vegetables, dead meat and live bullocks, sheep, pigs, geese, turkeys, ducks, fowls, fish, and casual game, are generally supplied at each port, so that it is difficult to estimate them. Probably two dozen bullocks and 60 sheep would be a fair average for the whole voyage, and the rest may be inferred in proportion. During the summer months, when traveling is heavy, 25 fowls are often used in soup for a single dinner.

GREENHOUSES AND CONSERVATORIES.

The time of year is now approaching when many who have been experimenting with the cultivation of plants or flowers during the past season bethink themselves of the possibilities of continuing, and perhaps enlarging, their work during the winter months, provided their means go hand in hand with the tastes which this pleasurable occupation usually begets, while others who have before done something in this line should not longer delay the making of contemplated enlargements and improvements. To all such the design herewith presented, of an English country house and conservatory, will afford suggestions for a roomy, highly ornamental, and yet not very expensive structure, which may be used both to raise and display plants. The chimney, built into the side of the house, suggests where the furnace should be placed, and in the most convenient place for so dividing the interior, either by permanent fixtures or sliding partitions, as to get the different temperatures required for various plants. A cool greenhouse is one intended simply to protect tender plants during the winter season, and the temperature may be as low as 35° to 40° F., but plants are not expected to grow in such a house; for flowers the day temperature must be at least 60°, with a minimum of 40° at night. It is evident that an abundance of light and ventilation are afforded by a conservatory of the design herewith shown. For heating such houses, the plan now most generally adopted is by hot water flues, though formerly, and at present in some of the smaller houses, the furnace flues alone are used, conducted around the house before entering the chimney. In the hot water system a pipe runs from near the upper part of the furnace hot water reservoir all around the house, under the different benches holding the plants, and returns to the boiler near its lower part, the fire in the furnace causing a constant circulation. A house constructed as the one shown gives great opportunities for display as well as for the cultivation of plants requiring different temperatures.

AN ORNAMENTAL CONSERVATORY.

The Nutmeg Plant—Myristica (*Var. Sp.*).

BY F. L. S.

ANALYSES OF NUTMEG.—(*M. fragrans.*)

	Ordinary kind. Bonastre, 1823.*	Ceylon nutmegs. 1880.
Volatile oil	6·0 per cent.	8·21 per cent.
Liquid fixed oil	7·6 "	} 35·76 "
Solid fat	24·0 "	
Acid	0·8 (?) "	....
Starch	2·4 "	} 1·85 "
Gum, etc	1·2 "	
Nitrogenous matter	..	6·70 "
Mineral matter	..	6·23 "
Cellulose and loss	54·0 "	33·73 "
Water	.. (?)	7·52 "
Loss	4·0 "	..
	100·00	100·00

The volatile oil of most species of *Myristica* seems to vary but slightly as to composition and physical characters, although it differs widely as to quantity. Some (Bentley and Trimen) assert the yield at "2 to 3 per cent," but the true nutmeg normally contains a great deal more than that, the wonderfully aromatic "nut" of Ceylon containing nearly 8¼ in 100 parts. The specific gravity of this variety is stated to be 0·927 by the author of the 1880 analysis, but from 0·920 to 0·948 has been named as the extreme limits, or range. *Myristicene*—a hydrocarbon—stated by Cloetz to constitute about three-quarters of the ordinary oil, but Dr. Gladstone has detected the presence of a small quantity of an oxygenated product, isomeric with menthole; for this the name of *Myristicole* is suggested. It appears to have the same properties as menthole when locally applied for the relief of neuralgia, etc.

The expressed oil of nutmegs—*Oleum Myristicæ Expressum*, or nutmeg butter—consists, of course, of a mixture of the volatile and of the fixed oils, and the yield is given, by Fluckiger and Hanbury, at 28 per cent of the nuts. It is chiefly imported from Singapore in square or oblong tablets or cakes, and some, recently measured, were found to be about 9½ inches long by 2¼ inches wide, of an orange-brown tint, fragrant and aromatic. The fixed oil, or non-volatile basis, of this "butter" contains several saponifiable fatty acids, *Myristicene* being the most prominent of these.

The method of preparing this "expressed oil" is to bruise the nutmegs and subject them first to the action of steam, and then to place in bags between the tested surfaces of large plates of iron previously heated, and subject them to great pressure, collecting the escaping oil in the usual manner. An important ingredient in the warm plaster and the *Emplastrum Picis* of the British Pharmacopœia, the "expressed" oil, either with or without mixture with *Lin. saponis*, is exceedingly useful as an external application for the reduction of sprains and the amelioration of paralysis, gout, and chronic rheumatism, etc.

The quantity of nutmegs annually imported into England amounts at present to from 640,000 to 660,000 pounds. France is content with something like half as much, and America imports about 470,000 pounds per annum.

The *Myristica sebifera* appears to be indigenous to the Brazils and British Guiana, and it is also found abundantly in Cayenne. It grows to about twice the height of *M. fragrans*, that is to say, 50 or 60 feet in height. The latter is said to contain no starch whatever; but this statement the present writer is able to deny, although the quantity of starch present in this nut is less than in most of the other varieties.

By drying the fruit in the sun, passing through rollers to break the shell, which is subsequently separated, crushing the kernel and throwing it into boiling water, some 29 per cent of fat is obtained, valuable for soap and candle making purposes.

The *M. laurifolia*, of Martinique, is very little known at present. A small specimen was placed in the hands of a well known analyst, who found 34·5 per cent of fat or oil.

M. punctata is chiefly remarkable for being without smell or taste. This variety is used in Brazil—its native habitation.

From the same country as the preceding comes the "ucu-uba," the fruit of *M. officinalis*. The flavor is amygdalaceous, but it has little or no taste; 18 or 20 per cent of fat is yielded upon macerating in hot water, and pressing, and this is much in demand for the purpose of soap and candle making, and as an ointment for the cure of asthma, tumors, and rheumatic affections. It begins to melt at 106° F., and forms a yellow fluid at about 170° F. This fatty matter dissolves in 3·1 parts of ether, 28·1 parts of hot absolute alcohol, but in the cold 105 parts are required to dissolve it.—*Br. C. and Druggist.*

* *Jour. de Pharm.*, 1823, pt. ix., p. 281.

Focal Distance of Spectacle Glasses.

Place the ends of a measure of 30 or 40 inches in length against a smooth wall or other suitable ground, in plain view of some well defined object a few rods distant, as, for instance, a building or window on the opposite side of the street. Then place the edge of your lens on the measure, and move it backward or forward until a spectrum is formed, or in other words, until a clear and distinct outline of the distant object is produced on the ground against which your measure rests. This point will represent sufficiently near for all practical purposes the exact focal distance of the lens, and will correspond in inches with the number on all properly marked convex spectacles.

Boring for Natural Gas at Cleveland, Ohio.

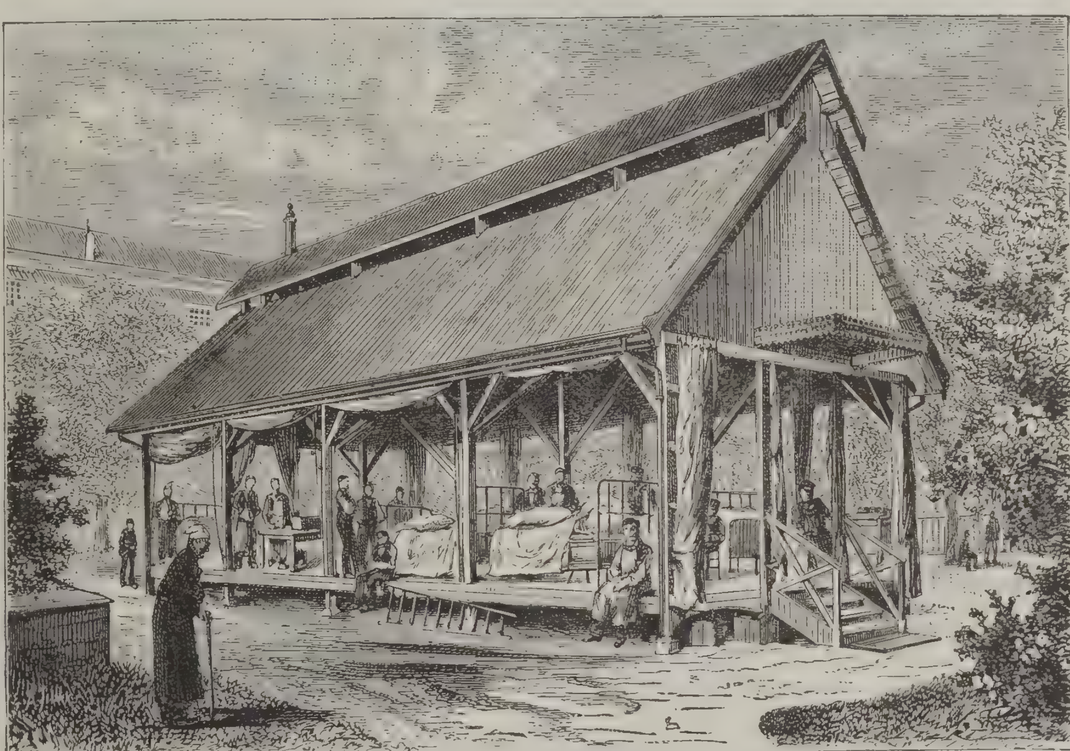
The Cleveland Rolling Mill Company of that city has been drilling for gas on its property in the Eighteenth Ward since October 10, 1884. At the depth of 715 feet a small vein of gas was found, but it was soon exhausted. After passing through the shale the drill entered a vein of limestone, 260 feet in thickness. Below this, hard gray sandstone was encountered. While the drill was pounding in the sandstone at a depth of 1,700 feet, the well suddenly filled with water, which, being pumped out, was found to be strongly impregnated with salt. The drilling was continued until a depth of 1,985 feet had been reached, when pure rock salt was found. This vein was 169 feet in thickness, and it required 36 hours to drill through it. The drillers were not in search of salt, but gas, and they continued with the work. The big salt vein was encountered about a month ago. Two weeks later, after drilling through a considerable amount of rock, another but smaller vein was encountered. The drill was still driven downward until it had reached a depth of 2,680 feet, and the drillers were treated to another surprise. This time they found petroleum. Evidences of oil were found in the shape of a peculiar odor about the borings. The drill was passing through very hard rock, and it therefore proceeded very slowly. Every time the sand pump was put down into the well it was filled with oil and water, and several barrels of petroleum were taken out in that manner. The oil is said to be of very fine quality. What has already been found seems to have trickled through the rock from a pocket near the well. No gas has been found since the drill passed below 1,000 feet. It is now producing about one barrel of oil daily. The hole has reached a depth of 2,700 feet, and according to the *American Gas Light Journal*, there are slight indications of gas, but it has not yet been discovered in paying quantities.

How Bees Predict the Weather.

No. 17 of *Die Natur* contains an article by Herr Emmerig, of Lauingen, on German bees as storm warners. From numerous observations, the writer advances tentatively the theory that, on the approach of thunder storms, bees, otherwise gentle and harmless, become excited and exceedingly irritable, and will at once attack any one, even their usual attendant, approaching their hives. A succession of instances are given in which the barometer and hygrometer foretold a storm, the bees remaining quiet, and no storm occurred; or the instruments gave no intimation of a storm, but the bees for hours before were irritable, and the storm came. He concludes, therefore, that the conduct of bees is a trustworthy indication whether a storm is impending over a certain district or not, and that, whatever the appearances, if bees are still, one need not fear a storm.

ISOLATING PAVILIONS FOR CONTAGIOUS DISEASES.

Physicians and hygienists have for a long time condemned that system of hospital buildings in which the patients, crowded in halls of a beautiful architectural aspect, find neither the necessary amount of air nor the isolation demanded by certain diseases. To cite the amount of expense occasioned by the construction of such edifices is enough to condemn a system that is repelled in the name of hygiene. Isolated pavilion hospitals are much the most healthful. During the war of the Rebellion the enormous number of wounded led to the improvising of barracks, which, as imperfect as they were, gave complete satisfaction to the heads of the hospital service. Experience, many a time repeated, has ended by triumphing over administrative routine, and, in many cities, a simpler and less expensive system is substituted for the edifices of old times. We may cite, as an example, the pavilions of Mr. Tollet constructed for the Bourges barracks, and, with a few modifications, made appropriate for the Bichat, Montpellier, and other hospitals. The hospital pavilion, or field hospital, shown in the accompanying cut, is situated in the gardens of the cantonal hospital of Geneva, and is designed to perform the role of an isolating ward for contagious diseases. It may likewise be appropriated to a service for the wounded, or, in a word, be adapted to all the needs of a hospital service. Among all the models of structures of this kind that have hitherto been devised, this is the simplest. It is built entirely of hard wood, simply varnished or coated with tar, and is 15 meters in length by 7 in breadth. To prevent dampness the floor is raised 70 centimeters above the ground. The roof, which has a steep pitch, is surmounted with a lantern to allow of the passage of air. The side walls are formed simply of thick curtains of sail duck. The structure contains eight beds. The arrangement, which is perfect for the summer season, appears to be less comfortable for that of winter, which is sometimes severe at Geneva. The walls then are lined with a double curtain, and the stoves that are installed in the interior suffice, it would seem, to keep up an equable temperature. When the infection of a ward necessitates its being evacuated, the patients are transferred to the pavilion, which offers the inestimable advantage of allowing them, during the extreme heat of summer, to be entirely in the open air. This is indeed an improved field hospital, of which the cost is not very high, and the erection of which may be effected very quickly.—*La Nature.*



ISOLATING PAVILION FOR CONTAGIOUS DISEASES

The Architecture of a Bone.

A lecture was lately delivered at the London Institution on "How a Bone is Built," by Mr. Donald McAlister, of St. John's College, Cambridge. The lecturer explained that he would treat the construction of a bone as a question of architecture or engineering rather than of anatomy. In looking at an ordinary marrow bone two points would strike one: In the first place, the shank or shaft of the bone was hollow, forming a somewhat thin walled tube; secondly, the end of the bone next the joint appeared on section to be not hollow, but filled with a spongy or "cancellous" meshwork of bony tissue. The tube form appeared not only in bones but in many other structures characterized by combined lightness and strength—such as the stalks of plants, reeds, bamboos, quills of feathers; and among human constructions in a vast variety of shapes, from tubular bridges to backbones of bicycles or tricycles. What was the common principle underlying all these manifold varieties? Why was it that, weight for weight, a hollow column was so much stronger than a solid one? The lecturer then showed that when an ordinary rectangular cross beam was slightly deflected by a load, the upper fibers were in a state of compression, while the under fibers were in a state of tension; whereas in the middle of the beam there was a neutral region neither compressed nor stretched. For load bearing purposes this region might be removed; the beam would thereby be made appreciably lighter but not appreciably weaker. The tube form of a bone was thus due to the fact that the material was concentrated at those parts which were most under strain and where it was most useful; it was removed from those parts where it added to the weight without adding to the strength. Tables were exhibited from which it appeared that bone in its physical properties resembled steel much more than such a material as cast iron. Bone, like steel, was almost as strong to resist tearing as to resist crushing. The spongy or cancellous ends of bone were next considered, and by photographs of actual specimens the lecturer showed that the apparently confused and irregular character of the tissue resolved itself on examination into a very beautiful and harmonious regularity. In the construction of such great structures as the Forth Bridge and the large cranes seen at the docks, engineers had found it useful to investigate the lines of the structure along which the pressure or the tension was at a maximum; these lines might be called stress lines *par excellence.* The material at disposal was most economically arranged when it was concentrated along these lines, leaving empty the mesh-like spaces corresponding to the neutral region of a cross beam. A skeleton or lattice framework might thus be built up, having all the strength of a solid structure of the same shape or loading, but with much less expenditure of substance. Such a structure would, moreover, be free from the danger of giving way by "shearing" or "faulting" in the geological sense. In other words, its parts would have no tendency to give way by sliding or slipping over each other; they could only be directly crushed or directly torn asunder. This was, therefore, an ideal mode of building such structures, and it was only because skilled workmanship was more expensive than material that engineers did not oftener put it into practice. In bone building, the lecturer said, there were no such obstacles in the way of perfect construction, and in such a part as the head of the thigh bone the principle was carried out in ideal perfection. The cancellous network in this bone was a material embodiment of the engineer's ideal lattice work of true stress lines, so much so that in the Zurich School of Engineering thin sections of the thigh bone were placed before the pupils as the best possible illustration of the true principle of construction. In conclusion, the lecturer remarked that when such instances of adaptation as appeared in the eye and hand, and perhaps he might now add the common marrow bone, were brought before us we were filled with wonder, and some saw in them evidences of what was called direct design. These evidences might nowadays be interpreted in perhaps a worthier and grander sense, but the wonder would remain for all who had eyes to see.

At any rate, apart from all theology, and taking only the strict architectural sense of the words, we must agree that a marrow bone was well and admirably designed.

John Henry Dallmeyer.

On the 30th of December, 1883, John Henry Dallmeyer, the gifted and noted English optician, whose name is familiar in every American photographic studio, passed away, at the age of 53. His name has been for a generation prominently before the world of astronomy, micrography, and photography. As a scientific optician he had no equal, and his works received acknowledgment and appreciation in various countries, especially in the United States, Austria, Germany, Russia, and France.

At home he was a Fellow of the Royal Astronomical Society; Russia constituted him a Chevalier, and France nominated him Officer of the Legion of Honor.

His marked ability in the construction of improved lenses for the camera made his name universally known among photographers. His demise will be generally regretted by the photographic fraternity, and those who are fortunate enough to possess his lenses will now doubly prize them.

We learn that his son, whom he has educated, will undertake to continue the business.

Waterproof Clothing.

Waterproof clothing which allows a free passage for respiration can be prepared by dipping in a solution of acetate of alumina. The latter is made by adding a solution of acetate of lead to a solution of alum, and decanting the mixture from the sulphate of lead which is precipitated. The articles are dipped into this liquid and allowed to dry without wringing them.—*Rundschau fur Pharm., etc.*

The Amber and Meerschaum Industry of Austria.

Within the last thirty years, says *Globus*, the amber and meerschaum industry of Austria has grown from a very small beginning to an independent and special branch, which is at present capable of producing excellent results, so that goods of great beauty and excellent quality are sold at relatively moderate prices.

The manufacture of articles from amber and meerschaum is chiefly concentrated at Vienna, although very respectable representatives of this branch can be pointed to in other large cities of that empire.

It is scarcely credible how wonderfully these two substances can be wrought, and what a variety of different articles can be made from them, simple or complex in form and all in excellent taste and elegantly made. It is only necessary to cast a glance into the show cases of the large Vienna amber and meerschaum firms in order to obtain an idea of the numerous elegant and artistic articles of magnificent workmanship that catch the eye of the passer-by and involuntarily invite to purchase.

First of all in elegance and variety is the immense collection of neat and elegant cigar holders, of the simplest as well as the most fantastic shapes. While in former years the magnificent meerschaum pipes ruled the day, at present, when cigars and cigarettes are used by nearly all civilized people, they are almost entirely superseded by cigar and cigarette holders. In addition to a variety of plainer ones we see such figures as angels, Venuses, veiled Venuses, sleeping Cupids, Indians with amber lances, jockeys with their horses, etc., also heads of women, of zouaves, and of Bedouins, and are astonished at the thousands of methods of combining these two substances, amber and meerschaum, and no less at the artistic design and execution of the articles. Equally varied is the collection of meerschaum pipes, that must enchant every passionate smoker. We see there the Dublin pipe of amber and meerschaum, the Albert, the Rigolbouche, the Irish, and the Belgian pipes, also the curved London and French pipes, and the Suez Canal pipes mounted in silver, meerschaum hand pipes with eggs, serpents, fruit, etc, all neatly and tastefully cut in meerschaum. Then there are the celebrated Turkish pipes, both flat and pointed, and a legion of pipes ornamented with character heads and other carvings. Then the never failing artistic objects with which large pipes are ornamented, carved in larger dimensions. Cigar holders ornamented with initials, monograms, or whole names sell well.

We must also state that, like meerschaum, amber is used alone, or both together are used for smokers' articles.

For many years past a new mass called artificial meerschaum has been made from the chips and turnings of genuine meerschaum, and at present it is largely employed. Besides this, different kinds of artificial amber are produced and used to imitate these various articles.

Amber is distinguished by its remarkably fine color, and like meerschaum it is turned on the lathe, filed, cut, and sawed, and from this expensive material magnificent ornaments are made, such as necklaces, earrings, pins, brooches, and bracelets; also smokers' articles, especially mouth pieces and cigar holders, also coral, cups, saucers, wreaths, etc.

Austria imports both of these valuable raw materials—amber and meerschaum—in very large quantities, the former mostly from Danzig, the latter chiefly from Brussa in Asia Minor. The quantity of raw material imported, as well as of finished goods exported, is simply enormous.—*Deutsche Industrie Zeitung.*

The Phylloxera in Sandy Soil.

The London *Times*, in a recent issue, contains a dispatch which gives the condition of the French grape crop as follows:

"Only twelve of the southern departments seem satisfied with their vintage. The yield in general is expected to be even below the average of late years. Burgundy and Champagne report a yield extremely deficient, both in quantity and quality, while Macon counts upon a better crop than had been predicted, though of somewhat poor quality. In Charente the quality is also poor."

The same dispatch, in summing up the observations of Lalande, Mayor of Bordeaux, on the conditions of the vines in the phylloxera-infested sections of the country, gives a most favorable account of the use of American stocks, and shows that even the French vines at Aigues-Mortes are flourishing in the sandy soils, thus emphasizing the fact of the impotence of the phylloxera in such sandy soils.

METALLIC PLASTERING SURFACE.

During the last few years there has been considerable attention directed to the use of wire cloth for plastering purposes, and attempts have been made to obtain the requisite solidity of the cloth combined with strength, cheapness, and durability. By corrugating the wire cloth at intervals about six inches apart and applying it directly to the wooden beams, joist partitions, board partitions, columns, girders, etc., it is stiffened and made firmer. It is secured by staples passed through the cloth in the corrugations, which are placed in such a manner that they run transverse to the joist or studding. By this arrangement the whole body of the cloth is stiffened and for the most part it is set out away from the edges of the joists, so that when the plaster is applied it will key around and through the corrugations and close around the edges of the joists, perfectly sealing them and preventing fire from passing from joist to joist. The patentee claims that this method is cheap, since no wooden or wire furring is required, thereby saving in the cost of material and time. The increase in strength is apparent, as the ribs in reality form a series of small girders six inches apart which impart rigidity to the cloth. The durability of the plastering results from the fact that it will not crack since the foundation is free from the shrinkage accompanying the use of laths. It requires no skilled labor to put it in place, and as every beam or joist is sealed, the danger arising from fire spreading is greatly reduced. The cloth may also be used in place of deafening boards to deaden noise and also for interlathing in frame structures.

The large engraving shows the cloth applied to partitions, walls, ceiling, columns, etc., the plastering being broken away in order to show the position of the cloth on the beams and joists. Figs. 1 and 2 clearly indicate the position of the corrugations in regard to the timbers. In the left of Fig. 1 is shown the method of uniting two pieces of cloth, the joint being formed in one of the corrugations.

This invention has been patented in this and foreign countries by Mr. James Stanley, of 114 East 83d Street, this city, who may be addressed for further particulars.

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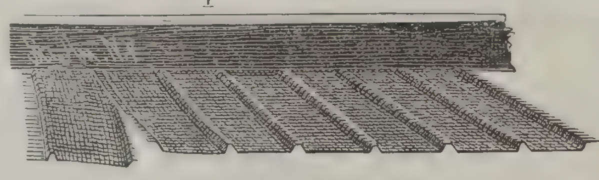

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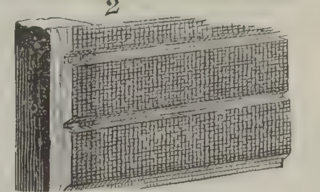
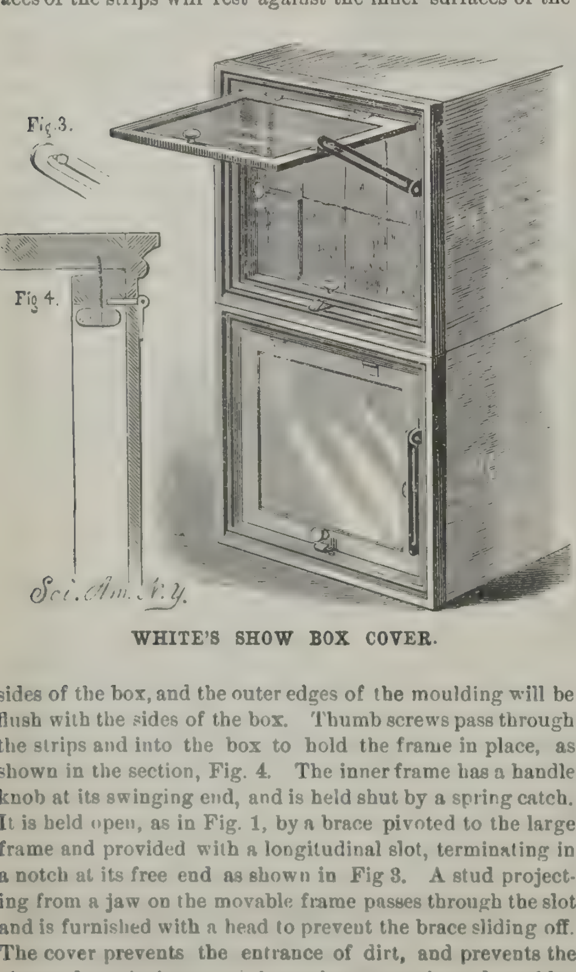


STANLEY'S METALLIC PLASTERING SURFACE.

SHOW BOX COVER.

The object of an invention recently patented by Mr. John G. White, of Pensacola, Florida, is to provide a hinged cover that can be secured on tobacco boxes after the usual cover has been removed, so that the box is kept properly closed, the removal of the tobacco facilitated, and the contents of the box exposed to view. To a frame made of either plain, stained, or painted mouldings, is hinged a second frame which fits into the opening in the first, and in which is a pane of glass. On the inner sides of the large frame are fastened strips a short distance from the outer edge, so that when the frame is placed on the end of a box, the outer surfaces of the strips will rest against the inner surfaces of the sides of the box, and the outer edges of the moulding will be flush with the sides of the box. Thumb screws pass through the strips and into the box to hold the frame in place, as shown in the section, Fig. 4. The inner frame has a handle knob at its swinging end, and is held shut by a spring catch. It is held open, as in Fig. 1, by a brace pivoted to the large frame and provided with a longitudinal slot, terminating in a notch at its free end as shown in Fig 3. A stud projecting from a jaw on the movable frame passes through the slot and is furnished with a head to prevent the brace sliding off. The cover prevents the entrance of dirt, and prevents the obacco from drying out or becoming too moist and mouldy.



WHITE'S SHOW BOX COVER.

Natural Gas Fuel.

While the use of natural gas economically and safely is still a problem in Pittsburg, according to the *Telegraph*, a company at Kittanning seems to have gone much farther toward practical success. The association was formed some months ago, and has pushed the fuel into general use. The well which supplies the gas is situated about two and a quarter miles from the town. The flow is steady and strong. The diameter of the tubing is five and three-eighths inches. The conduit pipe is three and a half inches, laid to a depth of a little over two feet, to the borough limits, where connections are made in various directions. These pipes are buried deep in the soil, to prevent injury from the effects of either heat or cold; but to make this important matter doubly secure, curved pieces of pipe are used along the line at different points, fixed in movable sockets, which allow room for all contraction or expansion of the pipes. Before the town is reached, two pipes are affixed to the main pipe from the well, a large and a small one, with two regulating valves, which are used to divide the pressure, so that one pipe may supply the iron works, grist mills, water works, and other places where a large amount of gas is consumed. The smaller pipe furnishes the gas for private houses, stores, public buildings, etc., where but a small amount of gas is needed. The pressure on both pipes is always shown at the main office by the gasometers attached to them. The high pressure pipe has a pressure of 80 pounds, and the low pressure 1½ pounds to the square inch. Small pipes connect with the main pipes, and are run into houses, stores, and all places where the gas is consumed. In all, over 100,000 feet of pipe have been laid by this company, besides that put by private parties into offices and residences; but so far, no breakage or rupture has been found in the pipes at any place in the numerous lines.

The iron workers at Kittanning say that in the puddling furnaces the fuel meets every want. Any degree of temperature needed can be obtained and kept at a fixed height. Atmospheric burners are used, by which the proportions of air and gas can be so regulated as to give the greatest or least amount of heat. The aperture through which the gas is conveyed into the burner is never more than one-eighth of an inch in diameter, and the mixed proportions of air and gas enter an iron tube about two inches in diameter and perforated with small holes, through which the gas escapes and burns. This iron tube is placed in furnaces, heaters, stoves, and grates, where the effects of the best heat are produced with little trouble.

The company is now furnishing over 800 fires in the town regularly. The cost of using the gas is moderate. Eight months in the year the rate charged is $8 per fire. Public buildings, manufactories, and hotels are given special rates. This is a great reduction on the use of coal. So far, the consumers are well satisfied, and the practicability of the new fuel seems entirely settled in Kittanning.

The Micrometer.

A "standard" micrometer has been made for the American Society of Microscopists by the United States Bureau of Weights and Measures. The scale is engraved on platin-iridium, 20 per cent iridium. The examination as to the correctness of this standard was carried on through seven months of last year by Prof. Wm. A. Rogers, of Harvard College Observatory, and it has now been accepted by the society. It is to be kept in approved safe deposit vaults, and not to pass out of the hands of custodian except with the permission of the Committee, President, and Secretary of the Society, but other micrometers will be compared with the standard, and the result certified to, for a reasonable fee.

Testing Machines.

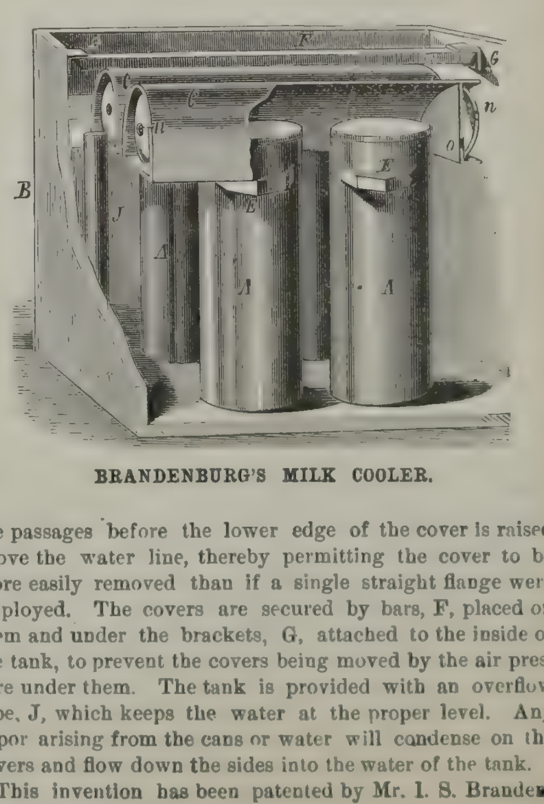
At a recent meeting of the American Society of Civil Engineers, a paper by Mr. A. V. Abbott, on "Some Improvements in Testing Machines," was read by the author, and illustrated by a stereopticon. A 200,000-pound testing machine was first described, its general construction providing for weighing the forces applied by means of platforms and levers somewhat similar to those used in ordinary scale work with special arrangements to reduce friction. To secure the direction of the pressure upon the test pieces in the axis of the machine, both ends of the piece are connected with segments of spheres moving freely in spherical sockets, which take the proper position upon the first application of the stress. Arrangements are also made by means of wedges to gripe and hold uniformly the ends of the test pieces. The machine is arranged to test in tension, compression, for transverse stress, for shearing, bulging, and torsion. In the machine illustrated, the action of applying stress is automatic, and at the same time the same power gives an autographic record of the stress applied and of any variations which may occur during the continuance of the stress, and with an instantaneous autographic record of the result at the conclusion of the test. The stresses are applied by means of weights which slide upon two parallel lever beams, the one registering up to 10,000 pounds and the other up to 200,000. By means of a remarkably ingenious electrical attachment connected with clock work, the movement of these weights is continuous and automatic, and the registering apparatus is also controlled by the same electric current. Diagrams automatically made by the machine were exhibited and described.

A number of broken pieces of steel were exhibited, and also specimens of woods which had been tested in various ways. Machines of smaller powers were also described, and a number of briquettes of cement were broken upon a small automatic machine which was exhibited.

MILK COOLER.

Two or more cans are placed side by side in a tank, and over each row is a trough-shaped cover, inverted and resting on the handles of the cans. The handles are located sufficiently below the upper ends of the cans for closing the cans by a water seal, when the tank is filled with water to about the height of the cans; and as the water rises under the covers the air therein is compressed, causing a pressure on the cream. The ends of each cover are provided with chambers, each having an outer convex wall and an inner straight wall. In both walls of the chambers are passages, *n o*, which are arranged in a vertical line. The upper passage, *n*, communicates with the open air, and the passage, *o*, is below the water line of the tank.

By this construction the ends of the cover are materially strengthened around the seal, so that the metal after constant use will not be liable to bend or twist, as is the case when a straight flange is employed. The inventor has found straight flanges uncertain, as they are liable to become bent or broken in use when not protected by a convex flange. The confined air under the cover is allowed to escape through



BRANDENBURG'S MILK COOLER.

the passages before the lower edge of the cover is raised above the water line, thereby permitting the cover to be more easily removed than if a single straight flange were employed. The covers are secured by bars, F, placed on them and under the brackets, G, attached to the inside of the tank, to prevent the covers being moved by the air pressure under them. The tank is provided with an overflow pipe, J, which keeps the water at the proper level. Any vapor arising from the cans or water will condense on the covers and flow down the sides into the water of the tank.

This invention has been patented by Mr. I. S. Brandenburg, of Peoria Ill.

PROCESS OF AND APPARATUS FOR BLOCKING ICE.

The accompanying engraving represents inventions relating to a process of blocking ice when it is thin by putting one or more cakes together and allowing them to freeze, thereby forming blocks sufficiently thick to house; and also to an apparatus for thus blocking. A cake of ice of convenient size (say 11 by 33 feet) is cut from the main field, and pushed down and sidewise beneath the field, being kept from moving inward too far by pins placed in holes bored in the main field the width of the cake, or 11 feet, back from the edge of the field. One or more holes are then bored through the field above the cake, and pins inserted to hold the cake in place, after which the first pins are removed. Another cake is then cut from the field and treated in the same way, the ends of the two fitting close together. Any number of cakes may be treated in this way, cut from the main field, and floated out of the way, being made fast by ropes or other means. When the tier of ice thus formed has become frozen into a solid mass, it is cut into blocks of the desired size for housing. Grooves or recesses may be formed in the cakes which are forced beneath the main field, for the purpose of allowing water to run in, which, by freezing, more perfectly cements the pieces together, so that there will be no possibility of their coming apart.

The apparatus for blocking the cakes consists of a number of longitudinally placed runners, fastened together by suitable cross pieces, and having handles upon one of the long sides, as shown. The apparatus is backed on to the cake of ice, one or more persons get on it, and with suitable instruments, assisted by their weight, force down the forward edge of the cake. The apparatus is then drawn forward until projections or blocks secured to the outer runners rest upon or over the field of ice, and spikes, fastened in the blocks below the projections, engage with the vertical edge of the field ice. The projections prevent any danger of the apparatus sinking under the weight of parties on it, after the cake of ice has been moved from beneath it, and the spikes prevent any end movement of the apparatus as the parties move about. The apparatus is held in its forward position by ropes secured to the ice by suitable hooks entering holes bored to receive them. The other ends of the ropes are attached to the outer ends of levers fulcrumed to the outer handles of the apparatus, the free ends of the levers engaging with notches in the inner handles, as shown in the engraving.

When the apparatus has been thus secured the cake of ice is worked from beneath it to its place against the pins, as already described. The apparatus is then disengaged from the ice by removing the free ends of the levers from the notches, and unfastening the ropes, when it is pulled on to the field of ice and backed upon another cake. In order that the apparatus can be moved lengthwise it is provided with supplemental runners at right angles to the main runners. These runners are hung beneath and to the cross pieces by rock shafts journaled in suitable boxes and secured to the runners by rigid arms. The shafts are operated by handles held in adjustment by suitable means. The runners can be drawn up out of contact with the ice, or lowered so as to raise the main runners from the ice.

These inventions have been recently patented by Mr. George W. Goodell, of Beardstown, Ill.

GOODELL'S APPARATUS FOR BLOCKING ICE.

Ancient Roadways.

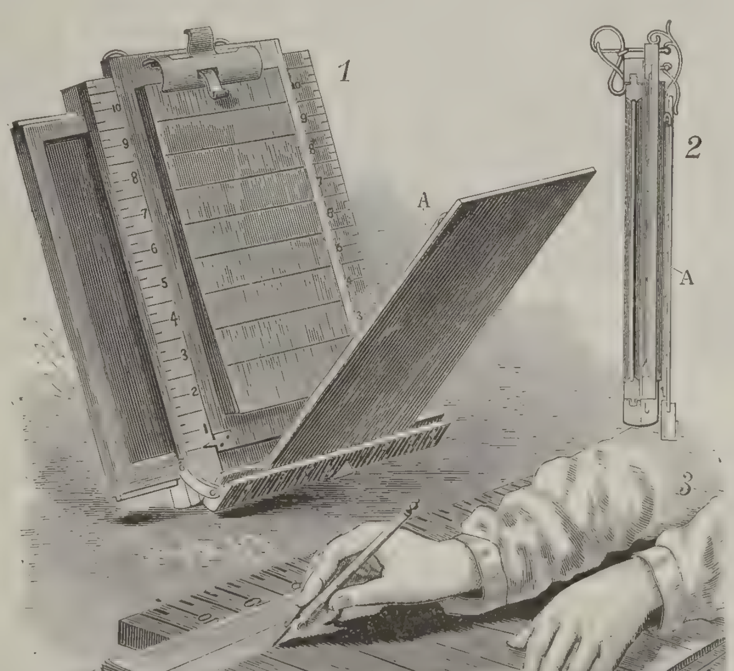
Whether in ancient times better roads and pavements were built than at present, or whether only the best ones remain, is uncertain, but it is certain that some of the remains of such structures found in Rome, for instance, evince engineering skill and perfection of work in a high degree. These were laid out carefully, excavated to solid ground, or in swampy places made solid by piles. Then the lowest course was of small sized, broken stones, none less than three or four inches in diameter; over these was a course, nine inches thick, of rubble or broken stones cemented with lime, well rammed; over this a course, six inches thick, of broken bricks and pottery, also cemented with lime; upon this was laid the *pavimentum*, or pavement, composed of slabs of the hardest stone, joined and fitted together as closely as possible. This was costly —the Appian Way, about one hundred and thirty miles in length, having almost exhausted the Roman treasury —but it was as enduring as Nature's own work. In Peru and Central America similar remains, 1,500 to 2,000 miles long, were found by the Spaniards, which, as Prescott says, were built of heavy flags of freestone, and in some parts, at least, covered with a bituminous cement which time has made harder than the stone itself. The roads of modern times lack most of the elements of durability which these possessed, and consequently wear out in a very few years. —*Kansas City Review.*

Cost of the Great Suspension Bridge between New York and Brooklyn.

The total expenditures for this work, including interest, up to the close of the year 1883, are stated to be over twenty-one millions of dollars. Probably there is no bridge structure in the world of the same small length that has cost so enormous a sum. This is doubtless due to the peculiar ways the politicians have in New York and Brooklyn of squandering time in the execution of public works and thereby swelling the costs. The river span of the bridge is only 1,600 feet, and the two approaches combined about 3,600 feet more—approximate cost of the structure, four thousand dollars per running foot, or three hundred and thirty-three dollars per running inch.

BLOTTER.

An invention recently patented by Messrs. L. H. Binkley and T. H. Wright consists of a device for holding writing paper, a blotting pad, and slates, the device being so arranged that it can be used for ruling the paper held in it. The board is provided at one end with a spring clip for holding the sheets of paper. A slate is held on the under side of the board.



BINKLEY & WRIGHT'S BLOTTER.

The end of the board opposite that on which is the clip is provided on each side with pintles, which pass into longitudinal grooves in the inner edges of the sides of a frame, thus adapting it to slide in and out of the frame, which is open at the upper end. Pointers, loosely mounted on the pintles, rest on the upper surfaces of the side bars of the frame, which are graduated, as shown in Figs. 1 and 3. The bottom cross piece of the frame is graduated on its upper surface, and is pivoted at its ends to links which are pivoted to the outer surfaces of the side bars at their lower ends. In the inner edge of the cross piece slides a board having a clip passing under the cross piece and forming a pointer on its upper surface. This clip prevents the removal of the board, but permits of its being moved and adjusted on the cross piece. A piece of blotting paper is held on the board by springs. A spring finger is pivoted on the upper end of the first mentioned board, and passes through a slot in the clip, so as to hold the covering board on the paper.

The construction is clearly shown in Fig. 2. A slate is held in a frame provided in its end pieces with tongues which slide in grooves in the end pieces, thus permitting the slate to slide laterally. The paper holding frame is provided at its upper end with two downwardly projecting spring legs furnished with prongs, that pass into notches in the under side of the slate frame, and hold it in place. The legs also form a support for the upper end of the board. The sheets of paper on the board can be ruled transversely by drawing a pencil along the upper edge of the blotter board, the paper board being moved out as the lines are ruled. The pointers sliding over the graduated side pieces of the frame permit of easily adjusting the board, so that the lines will be a regular distance apart.

If the sheet is to be ruled longitudinally, the blotter board is moved laterally, the pointer on the cross piece serving as a guide. If it is desired to write on the sheets the blotter board is swung down, and when the writing is to be blotted it can be swung back. If calculations are to be made while writing, the slate can be drawn out laterally. If it is not desired to write on the paper but on the slate, which is on the under side of the paper board, the blotter is swung down, the paper board is swung over it, and moved toward the upper end of the frame, when the slate is exposed. Both slates may be exposed by swinging the paper board down over the blotter. One of the sides of the frame is provided with a groove for receiving pencils, etc. In the engraving, Fig. 1 is a perspective view, showing the slate laterally extended, and the blotter board swung back from the paper. Fig. 2 is a longitudinal section, and Fig. 3 shows the device in use.

Further information concerning this useful device may be obtained by addressing the Rev. L. H. Binkley, of Bloomingburg, Ohio.

Slovenly Reading.

The *Journal of Progress* warns all men, old and young, against an evil thing which has been described as the "prevailing pestilence of slovenly reading." This pestilence has laid low many a one who began life with excellent prospects. It is ruinous both to mind and morals. It is apt even to injure a man's business habits and prevent him from winning success in practical affairs. In time it will confound all his faculties; it will destroy his capacity for clear perception, for precise thought, and for proper reasoning. It will throw into confusion his judgment and his memory. If he does not get rid of it he can never become a good writer, or do any literary work of any kind worth looking at. How many slovenly readers are to be found in these times! They will, in their slovenly fashion, read a newspaper article, perhaps a very excellent one, and when they have got to the end of it, or, as they say, when they have "looked through it" or "glanced over it," you will find that they are unable to give any accurate account of its argument, or that they do not apprehend its fundamental points, or that they have lost one of its links, or that they have overlooked an important illustration, or that they have failed to seize a word which is the very hinge of the writer's thought, or that they have wholly misunderstood the drift and purpose of the article which they have wasted their time in glancing over. These slovenly readers are an affliction to careful and correct writers. When such a writer sees how his reasoning and his language are distorted by them, his mind is apt to become ruffled, and every one knows how a ruffled mind unfits a man for the work of perspicacious composition. We are of the opinion that the prevailing pestilence of slovenly reading is largely due to the slovenly way in which children are taught to read at school. Teachers must be very careful about this thing; they must teach their scholars to read with precision and understanding, thinking of every word, getting the sense of each sentence, and grasping the full meaning of any piece that may be before them.

MASONRY IMPERMEABLE TO ACIDS.—Construct with bricks which have been previously dipped into very thick boiling tar, then lay in a mortar made of resin and a refractory sand applied hot, and rub the joints with a hot iron.

BRADFORD TECHNICAL SCHOOL.

In 1871 a new Mechanics' Institute, built at a cost of $162,000, was opened at Bradford, Eng., in place of one which had existed since 1839. It is in connection with this admirable institution that the new Technical School was lately opened by the Prince of Wales. In 1877 the council of the Mechanics' Institute considered the advisability of establishing a school for the purpose of giving technical instruction to those engaged in the various branches of the textile industry, of which Bradford is the center. By the co-operation of the Bradford Chamber of Commerce this scheme was carried into effect; gifts of machinery were not wanting, and in March, 1878, the Technical School was formally opened by the president, Mr. Henry Mitchell. The school became such a success that the accommodation afforded by the Mechanics' Institute was soon found to be insufficient, and the building of the magnificent establishment which is shortly to be opened was then discussed. Generous offers of aid poured in, and the result is a splendid erection, which has cost upward of $150,000, and which will provide technical education in every branch connected with the trade of Bradford.

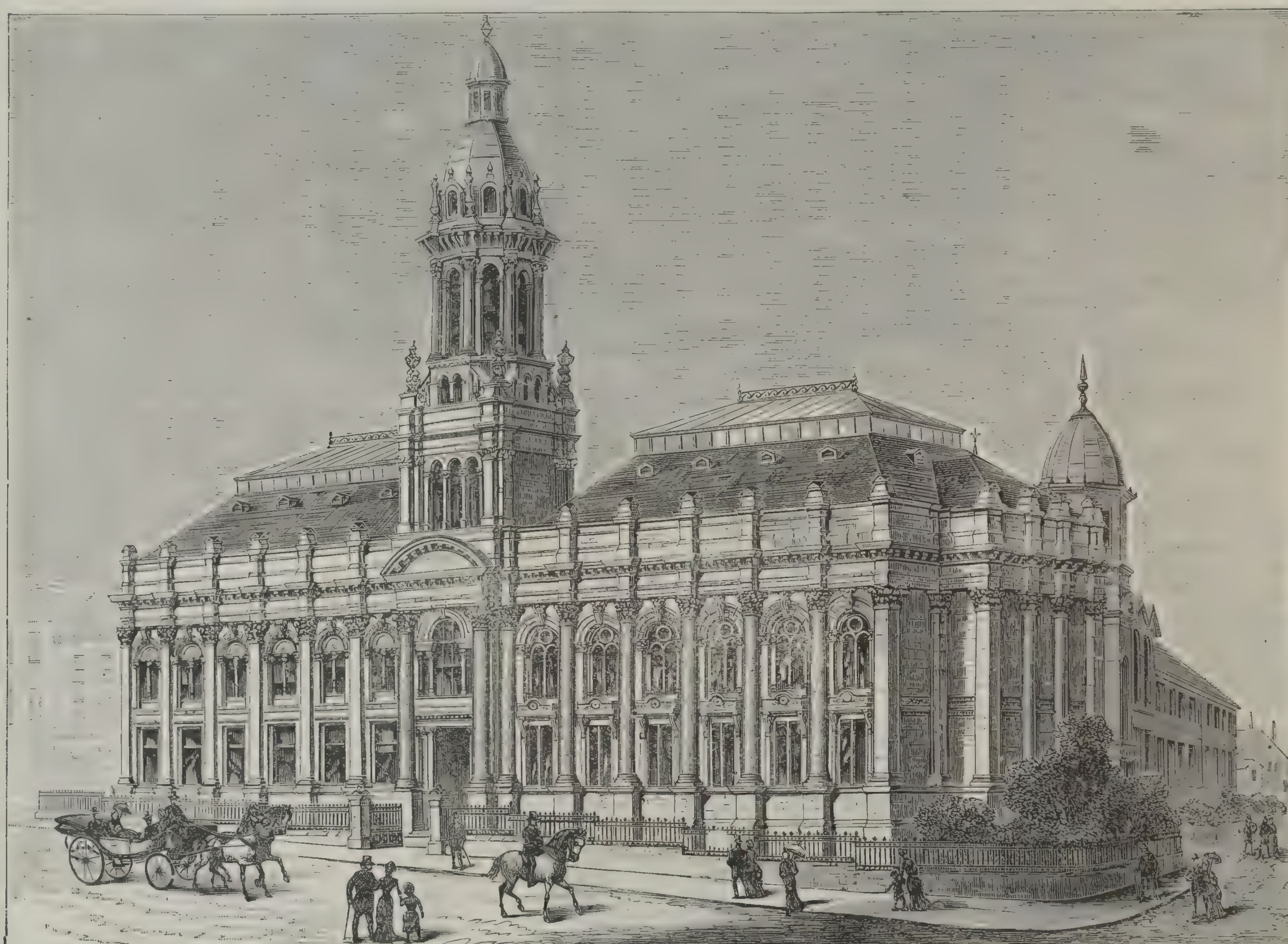
A staff of duly qualified masters will be constantly engaged in teaching day and evening classes. Among other advantages, exhibitions from the Board and other elementary schools will be provided. The sum for the carrying out of this splendid project has been provided by donations from the merchants and manufacturers of the district, and by a grant from the Clothworkers' Company.

It would require a separate article to do anything like justice to the Technical School building alone. It has a frontage of 160 feet to Great Horton Road, and a depth of 240 feet along Carlton Place. It contains a beautifully proportioned public hall (adaptable to dramatic purposes, and capable of seating 800 persons), a museum, chemical and dyeing laboratories, a science lecture hall, a council chamber, a library and reading room, a mechanics' workshop, weaving, spinning, and drawing sheds; and among others, art, painting, students', instructors', secretary's, chemical, "balance," dyeing, cloak, ante, curator's, and class rooms. Everything is on the most lavish and complete scale, and there is no modern improvement which has not been introduced.

Bradford possesses no less than four public parks, but the most fashionable of these is Lister or Manningham Park. It was purchased from Mr. S. C. Lister for a merely nominal sum, and a statue erected in honor of Mr. Lister now stands near the principal gate. The Hall was, until it became corporation property, the seat of the Listers, who are an ancient Yorkshire family. Mr. S. C. Lister, instead of leading a life of luxurious idleness, as he might have done, embarked in business pursuits at an early age, and has devoted most of his life to the invention of machinery. To him the credit of having invented the combing machine is, in a great measure, due; and, after the perfecting of that machine, he turned his attention to the utilization of "silk waste," which had previously been regarded as rubbish. With this object in view Mr. Lister spent many years of his life and over £300,000 in money before he received a single penny in return. He triumphed in the end, and at his gigantic factory vast quantities of silk, plush, and velvet are manufactured. The chimney is 83 yards in height, and absorbed 7,000 tons of material in construction. It is considered to be the sturdiest and handsomest in England, and it is a prominent feature for miles round.

Saltaire is a perfectly model town, situated on the banks of the Aire, about four miles from Bradford. It was founded by Sir Titus Salt, who discovered the use of the Alpaca wool, and erected one of the most celebrated factories in the world at Saltaire, which derives its name from its founder and the river upon which it is built. Sir Titus Salt built a handsome Congregational chapel, dwellings for about 4,000 work people, a noble club and institute, schools, infirmary, alms houses, etc., entirely at his own expense.

The foregoing particulars and the engraving are from the *Illustrated London News*. Our special object in presenting them to our readers is to call attention to the desirability of establishing numbers of such institutions in this country.



BRADFORD TECHNICAL SCHOOL.

Health and Education.

It is proposed to hold in London during the year 1884, says *Nature*, an international exhibition, which shall also illustrate centain branches of health and education, and which will occupy the buildings at South Kensington erected for the Fisheries Exhibition. The object of the exhibition will be to illustrate, as vividly and in as practical a manner as possible, food, dress, the dwelling, the school, and the workshop, as affecting the conditions of healthful life, and also to bring into public notice many of the most recent appliances for elementary school teaching and instruction in applied science, art, and handicrafts. The influence of modern sanitary knowledge and intellectual progress upon the welfare of the people of all classes and all nations will thus be practically demonstrated, and an attempt will be made to display the most valuable and recent advances which have been attained in these important subjects.

The exhibition will be divided into two main sections—I. Health; II. Education—and will be further subdivided into six principal groups. In the first group it is intended specially to illustrate the food resources of the world, and the best and most economical methods of utilizing them. For the sake of comparison, not only will specimens of food from all countries be exhibited, but the various methods of preparing, cooking, and serving food will be practically shown. The numerous processes of manufacture connected with the preparation of articles of food and drink will thus be exemplified; and, so far as the perishable nature of the articles will admit, full illustrations will be given of the various descriptions of foods themselves. In the second group, dress, chiefly in its relation to health, will be displayed. Illustrations of the clothing of the principal peoples of the world may be expected; and a part of this exhibition, which it is anticipated will be held in the galleries of the Royal Albert Hall, will be devoted to the history of costume. In the third, fourth, and fifth groups will be comprised all that pertains to the healthful construction and fitting of the dwelling, the school, and the workshop, not only as respects the needful arrangements for sanitation, but also the fittings and furniture generally in their effect on the health of the inmates. The most improved methods of school construction will be shown, and the modes of combating and preventing the evils of unhealthy trades, occupations, and processes of manufacture will form portions of the exhibition.

The sixth group will comprise all that relates to primary, technical, and art education, and will include designs and models for school buildings, apparatus and appliances for teaching, diagrams, text-books, etc. Special attention will be directed to technical and art education, to the results of industrial teaching, and to the introduction of manual and handicraft work into schools.

Cremation.

The great difficulty about cremation, and the principal obstacle to its general adoption, is so the London *Lancet* thinks, the danger of affording facilities for the commission of murder by poison. Would it not be possible to organize a system of post-mortem examinations in every case of intended cremation, so as to get rid of the difficulty? Beyond question it would be a good social policy, so far as health is concerned, to burn bodies instead of burying them; but it will not be possible to adopt cremation as a general practice until society has safeguards against the terrible danger to life which cremation undoubtedly creates. Such hideous crimes as those committed by Smethurst, Pritchard, and other notorious poisoners would never have been discovered if cremation had been in vogue.

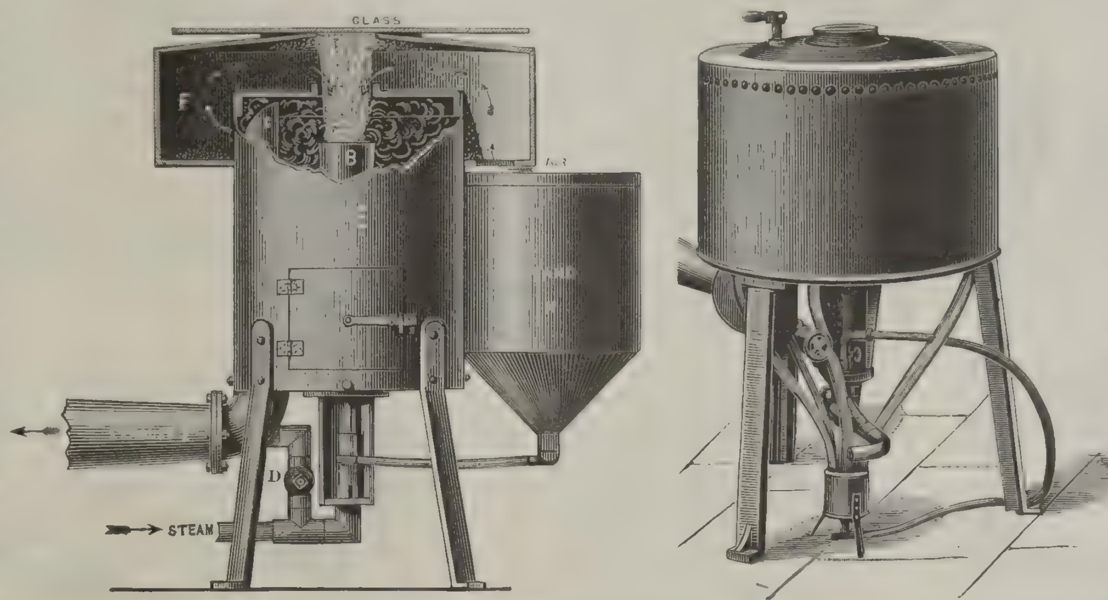
Hydraulic Mining to be Regulated.

The farmers of California have obtained from the United States Circuit Court a perpetual injunction against hydraulic mining. Reason: the billion tons of mud washed off the hills by the miners fill up the river beds, and the rivers overflow the farms 150 and 200 miles distant from the mines. It means the suspension of all work by thousands of miners scattered over an area of territory as large as the State of New York, and who have built 12,000 miles of mining ditches.

IMPROVED SAND BLAST MACHINE.

We give an illustration of an improved form of the Tilghman sand blast as designed by Mr. Mathewson, of London, in which the difficulties occasioned by the use of steam for driving the sand are in great measure overcome. Heretofore, by the sand blast process of cutting, boring, frosting, or ornamenting stone, metal, or glass, the use of steam as the propelling force is in most cases impracticable, owing to the condensation of the latter and the difficulty of manipulating the articles. Further, the stencil plates are liable to become clogged by the damp sand, and glass articles in particular are in danger of being broken from the heat of the condensed steam; the cheapest and most manageable substances are precluded from being used as patterns; and the waste sand must be dried each time it has been used. These objections have been overcome by Mr. Mathewson, by the use of an exhaust arrangement, which draws off all the steam before it reaches the article under operation, and at the same time dries the sand. The method of accomplishing this will be readily understood from the illustrations. The steam enters by the pipe, M, but by opening a cock, D, a small portion is deflected and enters the exhaust pipe, I, which terminates near the top of the chamber, E, the upper portion of the pipe being shown at C. This rush of steam produces a strong current of air in the direction shown by the arrows, which effectually dries the sand, and carries along with it all the steam and moisture through the exhaust pipe to the chimney. We have witnessed this apparatus at work, and can testify to the genuineness of the claims of the patentee. Sand blasting appears to be coming to the front more and more every year, and is now used for a great variety of purposes. We have seen sheet steel which was rolled in the ordinary manner, and then sand-blasted to remove the scale, and afterward heated and rolled again, which had thereby received a very high polish, and a surface capable of withstanding the effects of the weather. This system offers itself as a ready and effectual means of cleaning the surfaces of metal of all kinds from scale, etc., which is now effected by the use of acids, which penetrate metals and reduce their value for many purposes; also for incising ornaments with astonishing rapidity in granite and other stone.

An improved form of this apparatus is also shown. In this case, the sand after use falls into the hopper, and thence finds its way again through the four India rubber tubes shown into the small box below, from whence it is again ejected by the steam, and so on. The latest machines have a foot lever, by depressing which the operator makes the connection between the sand and the steam jet, but immediately the foot is removed from the lever this connection is broken, and the sand of course ceases to pass. We may also mention that a deflector is arranged in the interior of the case, which, by means of the handle shown on the top, can be brought in the course of the sand, and so deflect it, while the operator is adjusting the work. The velocity of the sand, of course, depends on the pressure of steam used, and so can be regulated to any desired degree. With steam at 60 pounds per square inch, and coarse sand, a hole 2 inches in diameter can be perforated through plate glass half an inch thick in two minutes.—*Mechanical World.*



IMPROVED SAND BLAST MACHINE.

THE CYCLOIDOTROPE.

BY GEO. M. HOPKINS.

The new and very pleasing and interesting lantern slide shown in the annexed engraving is of English origin. The maker's name is unknown to us, nevertheless we give him credit for having produced a simple device capable of illustrating on a large scale the intricate operation of engine engraving.

The figures shown in the smaller engraving were photo-engraved directly from plates, traced in the apparatus. They show some of the simpler forms of curves. By changing the adjustment of the tracing needle or the arms which support and guide it, an infinite variety of figures may be produced.

The ring, which revolves on the plate, is recessed around its inner edge, and lined with soft rubber for

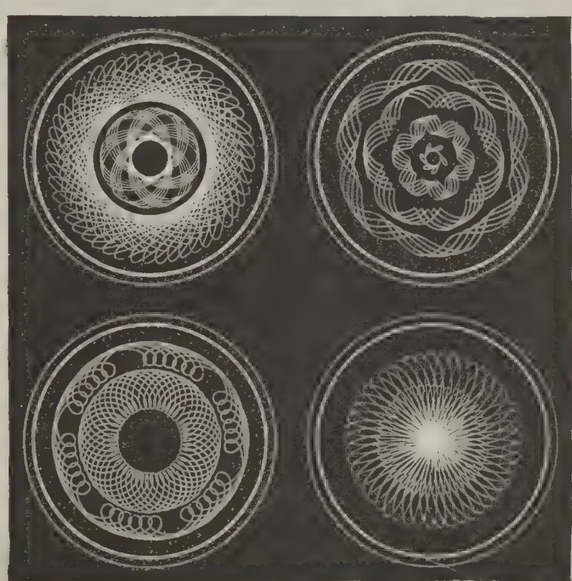


Fig. 2.—TRACINGS PRODUCED BY THE CYCLOIDOTROPE.

the reception of the glass disk, upon which the tracing is to be made. The glass is held in place by the pressure of two springs carrying rollers which bear upon the face of the glass at diametrically opposite points.

The face of the ring has a toothed rim, which is engaged by a small pinion on the crank shaft, and the periphery of the ring is provided with 202 spur teeth, which engage a pinion having 33 teeth and turning on a stud projecting from the base plate.

The spur pinion carries an adjustable crank, the pin of which turns in the crank arm, and is apertured transversely to receive the tracing rod, which may be clamped therein by the thumb screw.

The tracing rod passes through a stud arranged to turn in the end of the movable arm pivoted to the base plate. The tracing rod is hollow, and upon the end which projects over the toothed ring it carries a curved spring, provided at its extremity with a steel tracing point. A wire passing through the hollow tracing rod engages the under side of the curved spring, and lifts the point from the glass.

The glass is prepared for tracing by smoking it over a candle, lamp, or gas jet, or, better, by coating it with collodion to which some aniline has been added to give it the desired tint.

The glass having been secured in place in the toothed ring in the manner described, the tracing point is let down upon the glass by drawing out the wire in the hollow tracing rod. The toothed ring is then rotated by means of the crank, when a cycloidal curve will be traced on the glass. By continued rotation the curves will be duplicated; and as the number of teeth in the periphery of the ring is not an exact multiple of the number of teeth in the pinion, the ring will, by the differential movement, continually fall behind the movements of the pinion and tracer carried by the crank on the pinion, so that a small space is left between the lines of successive series. By continuing the operation the lines will intersect, until finally a beautiful, symmetrical network of lines will be formed.

By clamping the tracing rod in the crank pin, an approximately true cycloid curve will be formed; and by clamping the tracing rod in the stud projecting from the adjustable arm, and allowing the crank pin to slide on the rod, curves of another kind will be formed. Moving the arm on its pivot makes another change, and the figure is still further modified by changing the working field of the point from one edge of the glass disk to the other.

To render the tracing still more intricate, opposite sides of the glass disk may be coated with collodion differently colored. For example, red may be used on one side and blue on the other. The color of the ground when projected on the screen will then be purple. When the tracing is done on the blue side, red lines will appear on a purple ground; and when the tracing is made on the red side, blue lines will appear on the purple ground; and where the tracings of opposite sides of the glass cross each other, the lines will, of course, be white.

Besides the remarkable effects secured by the use of two colors, the thickness of the glass which intervenes between the two tracings produces a curious optical illusion on the screen. The tracing last made, if in focus, appears to stand out several inches from the screen, and seems to float in the air.

Another interesting optical illusion is noticed when, after rather rapid rotation, the disk is stopped. By the bias of the optic nerve the figures appear to turn backward.

The disks traced in this apparatus produce striking effects when used in a chromatrope in place of the ordinary painted disks.

This device has been exhibited at some of the places of amusement in this city for some weeks past. It universally creates among the spectators a murmur of satisfaction and surprise.

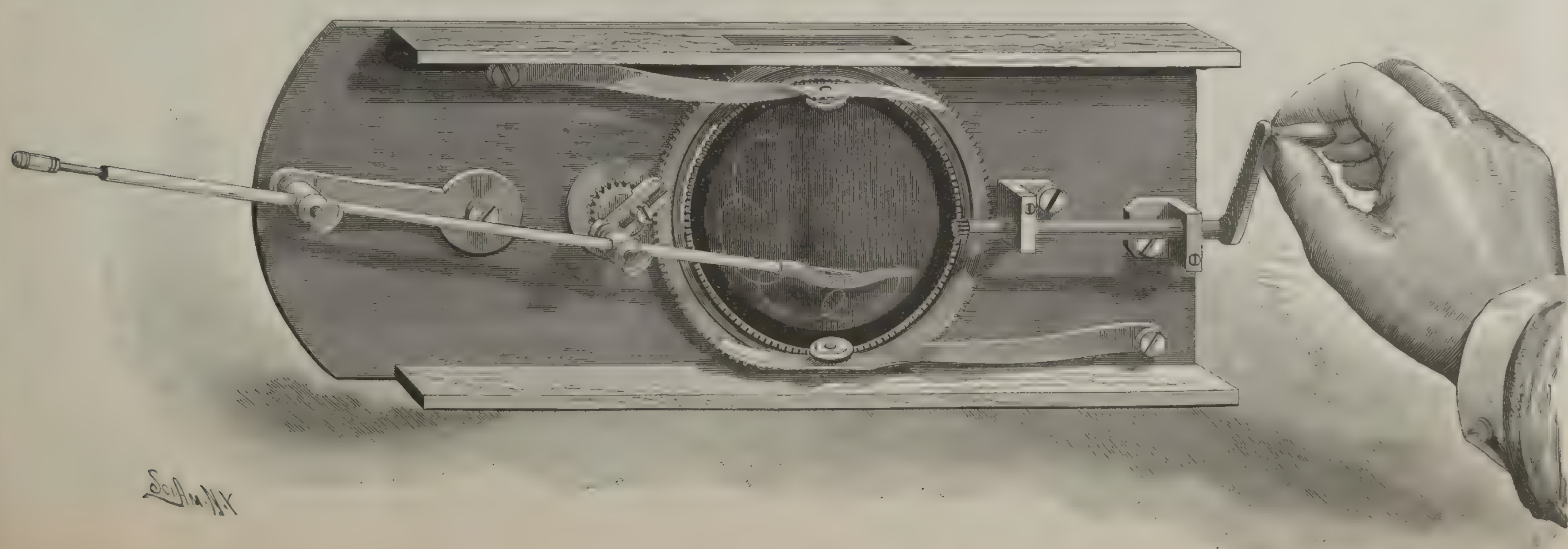
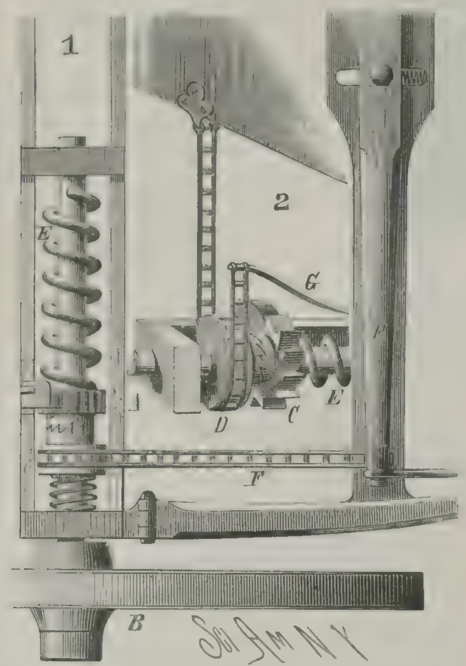


Fig. 1.—THE CYCLOIDOTROPE.

DRAUGHT DEVICE FOR VEHICLES.

The device herewith illustrated is designed to assist the draught of vehicles of all kinds by utilizing the jars of draught and the jolting of such vehicles to accumulate power on the axle, in order to give such part a forward motion. The wheels, B, are fixed to stub axles, A, journaled in bearings, as shown in Fig. 1. On each axle is a ratchet wheel, C, having peripheral teeth engaged by a pawl, and edge teeth engaged by what the inventor for convenience terms a "second



PAESSLER'S DRAUGHT DEVICE FOR VEHICLES.

wheel," D. The whiffletree, F, is pivoted in a slot supplied with a spring to ease the forward motion, as will be understood. From each end of the whiffletree a cog band, F', passes back around the second wheel, and is secured at its rear end to a spring supported by the framing. When the whiffletree is drawn forward, the band turns the second wheel, which also turns the ratchet wheel and contracts the spiral spring, E. The pawl holds the wheel at the point to which it is moved, and the axle is given a forward impulse by the action of the spring seeking to relax itself. The band is drawn back by its spring, when the draught is released by the stopping of the horse or other cause. This backward and forward motion of the connections alternately tightens and permits the spiral spring to impart a forward motion to the axle. In the construction shown in Fig. 2 the chain is connected at one end to the body, and after passing under the second wheel is secured to the spring, G; in this case the operation of the second wheel depends on jolts to depress the body, which in rising will revolve the second wheel.

The inventor of this device, Mr. T. H. Paessler, of Malvern, Ohio, claims that it would be of great use where heavy hauling is done with drays, lumber wagons, etc., and that its use would greatly reduce the labor of running a bicycle or tricycle.

BUOYANT PROPELLER FOR STEAMBOATS.

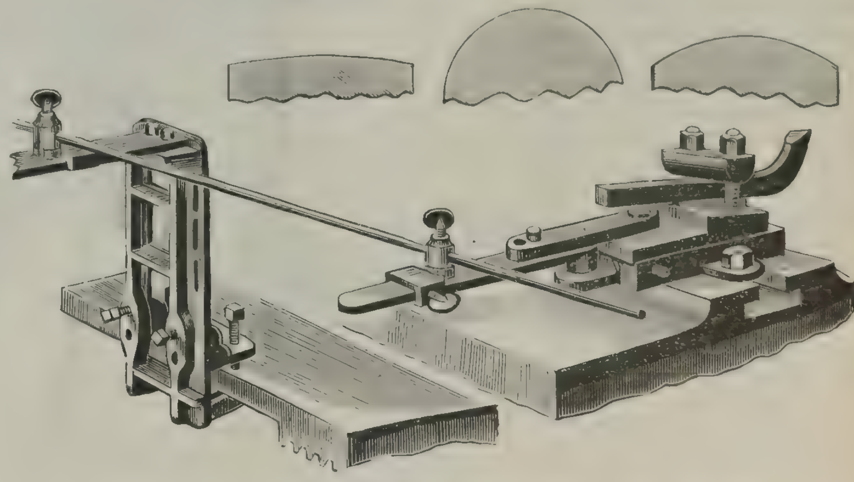
The two hollow cylindrical floats that support the body of the boat are preferably made cigar-shaped, and each is placed upon a central shaft journaled at their ends in uprights attached to the body, so that the floats may be revolved for propelling the boat. For this purpose the floats are provided with spiral blades at their rear ends. It will be noticed that these blades are only formed for a short distance from the ends of the floats—about one-third of the length—so that the water will not be ruffled directly under, but only in the rear of the float. The various means by which the floats can be revolved will vary according to the shape of the body, which may be in the form of a flat boat decked, as shown in the engraving. One arrangement for operating the floats consists of a crank shaft carrying a gear wheel meshing with a pinion of the float shaft; this gear wheel is connected by an intermediate gear with a pinion on the second float shaft. This invention has been patented by Mr. Wm. Hall, of 178 Bank St., Waterbury, Ct.

HALL'S BUOYANT PROPELLER FOR STEAMBOATS.

AUTOMATIC PULLEY TURNING ATTACHMENT FOR LATHES.

This attachment consists of a tool holder bolted to an ordinary lathe carriage in place of the tool post. A stand is fastened to bed piece of lathe near the head stock. A small rod from this stand connects with a lever on the attachment. As lathe carriage feeds along, this device causes the tool to describe the segment of a circle. By simply moving the slide on the lever to or from the tool, it will turn all the shapes shown in sections, or any desired shape from a flat to a round face. The attachment will give correct shape to face of pulleys up to 36 inches wide.

As lathe centers do not have to be set over out of line, it will take a heavy chip, and increase the capacity of the lathe from one-third to one-half. It is a simple, practical, and positive working tool. It is manufactured by American Twist Drill Company, Meredith, N. H.



AUTOMATIC PULLEY TURNING ATTACHMENT FOR LATHES.

M. Bartholdi in America.

The eminent sculptor, M. Bartholdi, who has just returned to France, after a visit of a few weeks in America, had several interviews during his stay in this country with the Secretary of War and other members of the committee who are to decide upon the design for the statue of Lafayette soon to be erected at Washington. While no definite contract has yet been made, it is understood that M. Bartholdi will in all probability be the artist selected for the execution of the work. His models are considered by far superior to those submitted by any of the competing artists.

The erection of the statue of Liberty naturally engrossed much of the sculptor's attention. The pedestal cannot be completed before midwinter; and as the statue is of such great size, and must be put up slowly and with the greatest care, the entire work can hardly be completed under about five months. M. Bartholdi proposes that the dedication shall take place on the 3d of next September, the anniversary of the signing of the treaty of Versailles, which secured peace after the war of the Revolution, and guaranteed the recognition of the American republic.

Underground Wires.

The Standard Underground Cable Company, of Pittsburg, have lately laid in this city an experimental electrical cable, connecting the headquarters of the Police and Fire departments. A trench about 4 feet deep was dug along the gutter on the north side of Houston Street, in which a wooden box to contain the cables will be laid. The cables consist of six insulated copper wires pressed in a malleable lead pipe and laid side by side in the boxes. The latter when closed up are to be covered with roofing pitch. All the wires of the fire alarm telegraph running out of the headquarters in Mercer Street are to be removed from the tall masts in front of the building and connected with the underground cables, and the police telegraph wires are to be similarly treated.

Power of an Ocean Wave.

In a paper by the Rev. Philip Neale, late British Chaplain at Batavia, in *Leisure Hour*, speaking of the great inundation from the sea caused by the Krakatoa earthquake, Java, he says: "One of the most remarkable facts concerning the inundation remains to be told. As we walked or scrambled along, we were much surprised to find great masses of white coral lying at the side of our path in every direction. Some of these were of immense size, and had been cast up more than two or three miles from the seashore. It was evident, as they were of coral formation, that these immense blocks of solid rock had been torn up from their ocean bed in the midst of the Sunda Straits, borne inland by the gigantic wave, and finally left on the land several miles from the shore. Any one who had not seen the sight would scarcely credit the story. The feat seems almost an impossible one. How these great masses could have been carried so far into the interior is a mystery, and bears out what I have said in previous papers as to the height of this terrible wave. Many of these rocks were from twenty to thirty tons in weight, and some of the largest must have been nearly double. Lloyd's agent, who was with me, agreed in thinking that we could not be mistaken if we put down the largest block of coral rock that we passed as weighing not less than fifty tons.

Improvement in the Manufacture of Mineral Wool.

This highly useful product from blast furnace slag was first made practically available by a German inventor some ten years ago, but several subsequent improvements have been made in its manufacture, improving the average quality and lessening the cost. Perhaps the most important of these is that covered by the recent patent of a Pennsylvania inventor. The wool is usually made by blowing jets of steam or air against a small stream of molten slag, converting the latter into fine vitrified fibers; but in this process, as heretofore conducted, only a part of the slag is converted into fiber, the rest forming hard granules or shot, which it has been difficult to separate from the fiber, the operation having a tendency to break up the fibers and make several inferior grades of mineral wool. By the recent improvement, the stream of molten slag falls into a space in front of a central steam jet pipe, with flattened orifice, tending to throw the stream of slag in fan-like shape; side jets are arranged to then meet the spreading stream of slag and force it inward and upward, where it is again met by other jets, giving it a swirling or twisting motion, but all the time under the action of the steam jets, until the stream of molten slag is discharged in conical shape, and enters the end of the receiving chamber. By this means, it is claimed, the entire product of the blow is what is known as No. 1 wool, the product being light and soft, uniform in quality, and free from granules or shot. This mineral wool is adaptable to so many purposes, more particularly in building, and, among engineers, as a non-conductor of heat, and it can be so cheaply made, that we are not surprised to learn of its coming into extensive use.

TO THE READER.

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OUR FIRST NUMBER.

The first number of the ARCHITECTS AND BUILDERS EDITION of the SCIENTIFIC AMERICAN was issued November 1, 1885. Its contents are of much interest and value, as will be seen from the table given below.

It is accompanied by two supplements, consisting of two plates in colors, illustrating a country residence, by O. P. Hatfield, architect, and a large sheet of details pertaining to the same. The November number is further illustrated by fifty choice engravings.

TABLE OF CONTENTS

Of the November number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked *.)

OUR SECOND NUMBER.

With the December number we sent two large supplements, one of which comprises colored plates illustrating a beautiful and attractive country residence by Mr. John E. Baker, the well known architect of Newark, N. J. The other supplement consists of a large sheet of details of the same.

TABLE OF CONTENTS

Of the December number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked *.)

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Gelatine paper may be obtained already prepared, is used in a dry state, is always ready for use, and will retain its sensitiveness for any length of time, so that it affords the photographer and amateur a ready means for quickly making positive prints, at any time.

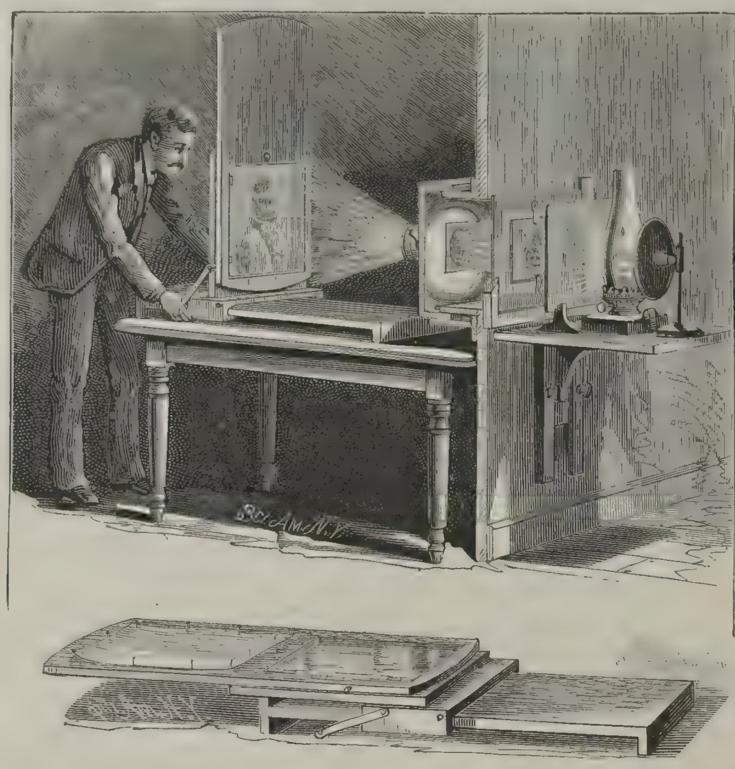


PHOTO-ENLARGING APPARATUS.—OBTAINING THE FOCUS.

Our engravings illustrate two forms of apparatus for exposing upon the sensitive paper. The upper engraving shows a photographic dark room separated by a partition from the exterior room.

Upon a table is placed a board on which a saddle slides back and forth. An upright frame is hinged to the upper side of the saddle, and when in use the frame is held in a vertical position by a flat metal latch as shown. At the upper end and in front of the frame is pivoted a board twice the length of the frame, provided at one end with a large rectangular opening covered with a ground glass, the ground side being set flush with the face of the board. The board revolves edgewise in a vertical plane, and is perfectly balanced. The small engraving shows the position of the board when folded up. Arranged upon the interior side of the partition of the room in front of the focusing board is a camera box made in two parts, the front portion, with the lens attached, sliding over the rear half, which is secured light-tight around a rectangular opening in the partition.

A short focus lens of the portrait combination type, provided with a diaphragm of an inch aperture, produces the best results.

The negative, with the film side toward the lens, is held in the slide in an inverted position, and is slid into the grooved frame upon the exterior side of the partition, as shown. This arrangement allows different sized negatives to be quickly and easily adjusted. On an adjustable shelf, which can be raised or lowered, is located the ground glass, kerosene lamp, and reflector. The center of the lamp flame reflector, negative, and the lens of the camera should be in one focal line.

The ground glass in front of the lamp diffuses the light equally over the negative; an ordinary magic lantern condenser may be used in place of the ground glass, thereby materially decreasing the time of exposure.

Our picture shows the operator in the dark room in the act of obtaining a focus; the room is supposed to be closed to all outside light except that which comes through the lens, and the enlarged image of the negative is seen very distinctly upon the ground glass of the focusing board. The saddle is moved back and forth until the correct focus is obtained, as, for instance, when the hair of the head or the pupil of the eye looks sharp and distinct.

The picture appears very soft, and viewed at a little distance shows a remarkably pleasing, crayon-like effect. The size of the enlarged image may be regulated by varying the distance between the lens and the negative. Our lower engraving illustrates the method of exposing the enlarged negative image upon the sensitive paper, showing how the operation can be carried on in one room. The amateur photographer only needs to provide a board having vertical wings or sides which fit tightly around the sides of the back of his camera, allowing the bed of the same to slide in and out easily. A frame holding the negative is secured to the back of the camera in place of the usual ground glass, the latter is suspended just back of the negative, and at the rear end of the wings is located the lamp with reflector inclosed in a metal box. The arrangement is clearly shown in the small cut.

Holes are made in each side of the lantern box at the top and bottom to admit a free circulation of air, and are protected from the light by interior deflectors. A door at the rear end of the box allows the lamp to be removed. A tin cracker box can be successfully arranged to hold the lamp.

The space at the top between the rear end of the camera and the top of the lantern box is covered by a velvet or other black cloth, to exclude the light. As before stated, the center of the light, negative, and lens should be in one focal line.

Having obtained the correct focus on the ground glass on the focusing board, the operator covers the lens with a cap of ruby glass, turns the ground glass end of the focusing board up, and fastens on the lower portion, in proper position, the sensitive sheet. When the sheet is rightly located the hook may be unlatched and the board turned flat, as shown, so that the paper may be more easily pinned to the face of the board; the latter is again raised, secured, and made ready for the exposure. As a vignetted picture is the most pleasing, and can be easily made, the operator needs to provide before exposure a cardboard having a notched oval aperture which, during the exposure, is held between the lens and focusing screen as shown. Looking upon the screen the dull red enlarged image may now be seen, but the moment the exposure is made by removing the red cap from the lens, the picture becomes suddenly bright and brilliant. The operator then moves the vignetting card to and from the exposed sheet, thereby decreasing and enlarging the vignetting circle. In this way the beautiful soft blending so characteristic of vignetted pictures is easily produced. With a lamp like a No. 3 Leader kerosene burner, giving a flame about $3\frac{1}{2}$ inches wide by $1\frac{1}{2}$ inches high, and of about 26 candle power, an exposure of four minutes has been found sufficient. The exposure may be quickly stopped by replacing on the lens the red cap.

The exposed sheet, with the latent image impressed thereon, should now be removed to a light-tight receptacle, where it may remain ready to be developed at the convenience of the operator.

Full directions in regard to exposure, development, and fixing are sent by the manufacturers of this gelatine paper.

As the process is so simple and the manipulation so cleanly and easy, nothing could be more pleasing, interesting, and instructive to the amateur than to amuse himself by enlarging as described.

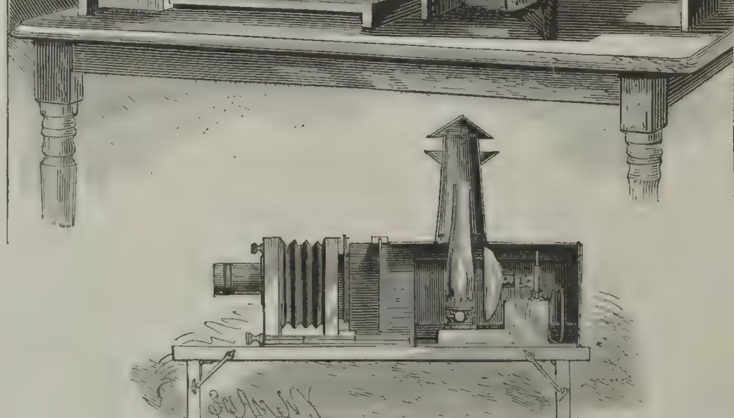


PHOTO-ENLARGING APPARATUS—MAKING THE EXPOSURE.

The pictures are permanent, possess a soft, crayon-like appearance, and when finished form a beautiful adornment for one's walls.

Gelatine rapid printing paper is likely, therefore, to come into extensive use, and we predict for it a brilliant future.

SIR JOHN HERSCHEL first produced the tints of the spectrum on a daguerreotype in 1839.

Art Study.

An address was recently delivered by Professor W. Boyd Dawkins, F.R.S., at the distribution of prizes to the students of the Brighton School of Science and Art. In the course of it he said there were two important requisites or corner stones to the proper study of art. The first was that by which a student was enabled to see things. It was absolutely necessary, before anything could be represented properly, that it should be seen properly. He knew from his own experience that it was one of the rarest things in the world for a man really to be able to see a thing properly. But he did not know that a man could learn to see things outside himself properly better than by trying to represent them. A man could not realize the beauty of a figure or a landscape, unless he had attempted to draw them. Until he had a knowledge of the essentials to the production, until he could pick out the salient points in the landscape or figure, he doubted much whether any man could be said to have seen the one or the other. With regard to the second corner stone, the power of representation, he thought there was as great a dearth in that direction as there was in the power of seeing. He believed that many artists who had reached the highest rank in their profession were deficient in the capacity of adequately representing what they saw. He therefore desired to impress upon the minds of the young art students that their first duty was to represent in their art what they actually saw, and what was true.

They must study the conditions and master the surroundings of the picture which they had to represent, and, above all things, try to be true to nature. The Professor then called attention to a number of rough sketches of animals, fishes, etc., arranged at the back of the platform, which, he said, represented the earliest traces of art known in Europe. Pointing to one sketch, that of a reindeer feeding, he said his audience would notice that the outline was wonderfully well done. Its unmistakable contour was clearly defined, and was altogether a piece of true art. When they saw such a figure they were perfectly certain that the individual who drew it represented exactly what he saw. Yet those drawings were originally produced upon fragments of antlers and of bone and little pieces of stone, while the drawing implements those early artists had at their command consisted only of rude splinters of flint. Those drawings also indicated that the young artist should not begin with the brush, painting away with indistinct outlines, but first try to represent objects by bold outlines, which, he believed, was the best way of arriving at a thorough mastery of art.

In conclusion, the Professor stated he would say a few words regarding some other things. He thought there was in this country most unfortunately an antagonism existing between handwork and headword. In this country there were two distinct lines, if he might so put it. There was one which he might call the professional line, where it was considered a very fine and estimable thing for a man not to work with his hand, but with his head or pen. That antagonism seemed to him most unfortunate, and he thought all students should bear in mind that it was a thing which really ought not to exist. It would not exist if it were not for an intensity of vulgar prejudice. He would say that the old craftsmen of Italy, those men who were the builders of Florence and other great cities, were men who had no prejudice of that kind, and he thought that, if they really wished to do their work in the world, they must get rid of that absurd and ridiculous prejudice as quickly as possible. The work truly done was equally noble, and the man who made a table to the best of his ability was equally great, as far as his work went, with the man who painted a beautiful picture or composed a beautiful piece of music. That consideration led him to another point, and that was—What was to be the end of all this higher education? It seemed to him that if the end of it all was the production of more professional men—more doctors, more lawyers, more clergymen, more professors, and more clerks—the less they had to do with it the better. The professional classes were being overstocked, owing to that vulgar prejudice, and if education was to be of any good it should aim at making a man better fitted to carry on his work in the world than he was before.

His opinion was that the best education was that which would make a man better at his handicraft. If a man had the chance of pushing forward in the world let him do so, but if he tried to get out of his own line of life let him do it at his peril. It appeared to him a most ridiculous thing that a man who knew a great deal of Latin, or geology, or chemistry, should on that account think himself entitled to be supported by the State. The education he had in his mind was that which was not confined to the rich, which belonged not to one class any more than the other, but to all, and which would enable all classes equally to do their work better in the position in which they found themselves.

THE NEW UNITED STATES WAR STEAMER CHICAGO.

THE U. S. WAR STEAMER CHICAGO.

Length between perpendiculars, 315 ft.; length on water line, 325 ft.; length over all, 334 ft. 4 in.; depth, garboard strake to under side of spar deck, 34 ft. 9 in.; height of gun deck port sill from load water line, 10 ft.; height of spar deck port sill from load water line, 18 ft. 6 in.; breadth, extreme, 48 ft. 2½ in.; draught of water at load line, mean, 19 ft.; displacement, 4,500 tons; area of plain sail, 14,880 sq. ft.; complement of men, 300; battery, four 8 in. long breech loaders in half turrets, eight 6 in. and two 5 in. on gun deck; indicated horse power, 5,000; sea speed, 14 knots; capacity of coal bunkers, 940 tons; built of mild steel, divided into ten water-tight compartments by nine transverse bulkheads extending to the gun deck. See illustration, page 117.

HEREFORD CATHEDRAL.

A view of this cathedral, by the late Mr. S. Read, is presented on page 120. It is an edifice which, besides containing some important Norman building in the piers of the nave, choir, and south transept, is rich in the Early English and in the Geometrical Gothic style of architecture. The Early English Lady Chapel is an excellent example of that period; but the north transept, showing the transition to Decorated Gothic, is still more remarkable. Extensive "restorations" have been effected, not always with the best judgment, as in Wyatt's work from 1788 to 1797; but of late years, under the direction of Sir Gilbert Scott, much has been done to remedy the mischief previously suffered. The Bishopric of Hereford is one of the most ancient in England, dating probably from the sixth century, or certainly from the seventh; it is now held by the Right Rev. James Atlay, D.D., who was consecrated in 1868, and who is the ninety-fifth in succession.—*Illustrated London News.*

Memory Versus Progress.

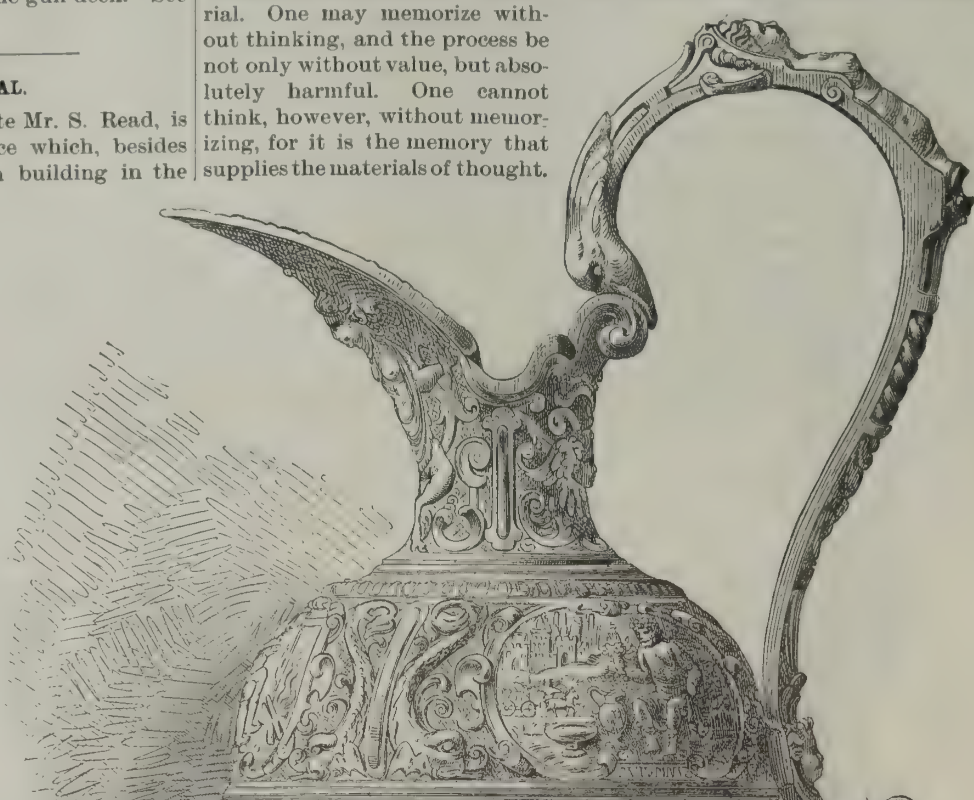
It has been suggested that memory, the virtue that we have all sought to cultivate, is, after all, the worst foe to thinking. In a certain sense, the suggestion is true. The capacity of the brain is limited. It has corners and chambers where facts, like corn in a granary, may be stored away for future use. But it has likewise passages and corridors which must be kept clear and unimpeded if the treasures of the storehouse are to be available. The busy guardian which we call thought must have a little space in which to marshal his forces, and accomplish his intricate evolutions. It is necessary that there should be a workshop as well as a storeroom.

There is one problem in a human life which surpasses all others in importance. It is the development of character. This rests in a large measure upon those qualities of the mind which are capable of cultivation. The doctrine of heredity has taught a great natural truth from which there is no escape. But it must also be held responsible for the revival of the unfortunate doctrine of fatality. The narrow cranium which limits the possibilities of development is an inheritance which cannot be denied. But the limitations are quantitative. The same virtues, the same sound habits of intellect, are open to all. It may be more of a struggle for one man to attain mediocrity than for another to reach eminence, yet the man who relinquishes the effort on this account is but a cowardly soldier. The difference between the street laborer and the *savant* is one of degree, and not of kind.

It will take but a small experiment to convince men that the question of mental development is one singularly under their own control. The difficulty is to get them to make an honest trial in self-government. They hesitate to make the attempt.

They complain of the inequalities of society and of the unlucky star under which it has been their misfortune to be born. Let them look inward. They will find a power, hitherto dormant, whose exercise would be more effective than position or birth in bringing the best possibilities of life within their grasp. It is the power of individual effort.

In biology, the principle of evolution has explained a great many seeming discrepancies. It has brought harmony into that infinite procession of organic life. Yet in the field of psychology the principle of evolution is not less applicable. Mental evolution is indeed established upon a firmer basis than physical. The rise from obscurity to greatness of most of the present leaders of the world is a sufficient demonstration of its reality. The question of development is decided largely by the mental habits of the individual. A man may have an ocean-like receptivity, but the facts which he stores away will have little value unless they be assimilated and made a part of his thinking material. One may memorize without thinking, and the process be not only without value, but absolutely harmful. One cannot think, however, without memorizing, for it is the memory that supplies the materials of thought.



SUGGESTIONS IN DECORATIVE ART.—TIN JUG IN THE NATIONAL MUSEUM AT MUNICH.—*From Workshop.*

The delicate balance between the limits where memory will suffice and where thought is requisite will determine by its adjustment the mental habits of the individual, and by repetition stamp his character. It is well for a man to stop occasionally and examine these mental habits. He is the sole guardian of this inner world.

Friends and associates can reach a pretty correct analysis of the processes which must be back of the manifested action, but he alone can know them thoroughly, and, what is more important, he alone can effect a change where he sees the habit to be slovenly or the point of view narrow.

It is well for him to know whether he is simply remembering, reflecting in his own speech and action what he sees and hears, or whether he is really mentally alive, and permitting his brain the exercise of its highest function—thought. The formation of his character depends upon which course he is pursuing. It is a true friend who cries, "Halt! What news? Are you alive? Do you think? Is your brain vital, your life individual, or are you simply reflecting the good and bad of your narrow environment? Do you see, hear, act for yourself? Do you direct the currents of life, or are you drifting? Are you a living organism or one of the dead tissues of society?"

If the questioned be a wise man, he will not resent the question, but will try to answer it truthfully. Should the answer not be what he would wish, he will not shrink from the embarrassment of acknowledgment. When in time, however, the question is repeated, the answer will be more favorable. But what good friend would speak so plainly? Can't you guess? If a man is sometimes his own worst enemy, he can redeem the record, and be for once his own best friend. Let him ask the question himself.

Efflorescence on Brick Walls.

In discussing the cause and cure of the white efflorescence which often appears on brick walls, before a recent meeting of Illinois architects, Mr. J. C. Anderson stated that the principal ingredient of the disfiguring, frost-like substance is sulphate of magnesia. This is formed from the sulphuric acid which the bricks absorb from the fuel in firing and the magnesia which is usually present in considerable quantities in the lime of the mortar. Most of our limestones are dolomitic. In laying the back courses of an ordinary wall, the bricks are saturated with water. In the process of drying out, the water carries the sulphate of magnesia through the facing bricks to the outside, where it crystallizes. The explanation seems probable from the fact that the efflorescence appears only on comparatively new buildings, and shortly after erection. In older buildings, also, the lime of the mortar was more generally burnt with wood, and consequently the source of the sulphur was removed. Mr. Anderson recommends the use of less water in brick laying, of pure lime for the mortar, and finally the isolation of the front bricks from the more porous ones behind by some material impervious to moisture.

Waiting to be Invited.

"Why don't you trade with me?" said a merchant to an acquaintance the other day. "Because," was the reply, "you have never asked me to. I have looked all through the newspaper for an invitation, in the shape of an advertisement, but in vain. I never go where I am not wanted."

On reading the above in one of our exchanges, the thought it suggested was, that there are undoubtedly a good many persons who contemplate changing their machinery or adding to what they already have the coming spring, and that manufacturers of all kinds of machinery would be wise in sending out, through newspapers of large circulation, invitations to users of such wares as they make to call and see their stock, or write to them for particulars.

ASPHALTED JUTE.

ACCORDING to the *Journal des Fabricants de Paper*, a material called asphalted jute is being largely employed in Germany for covering roofs, for isolating damp walls and floors, and for preventing bad odors from reaching apartments situated over stables, etc. It consists of strong jute cloth coated with specially prepared asphaltum, and covered on each side with strong, asphaltum-coated paper. In order to obtain a very compact product, the whole is submitted to very strong pressure. The material can be used on farms for making tight reservoirs, in the construction of bridges, and in many other cases where there is need of a material that is at once strong, impermeable, and cheap.

THE MERCURIC DEVELOPER.

By HENRY J. NEWTON.

AT the November meeting of the Photographic Section of the American Institute, I gave my formula for an accelerator, which, curiously, has been mixed with the formula I had on a previous occasion given for an intensifier of the mercury salt, so that, if used as misquoted, it would be useless for such purpose, and spoil the developer. In order that my formula may have a fair test, and also to prevent people from wasting their time uselessly with a foolish version of it, I thought it best to have it correctly reprinted in the *Times*.

A.

Bichloride of mercury	30 grains.
Water	4 ounces.

B.

Iodide of potassium	90 grains.
Water	1 ounce.

When the two salts are thoroughly dissolved, pour the iodide into the mercury solution gradually, until all is added. The result should be a clear solution, as the excess of iodide will dissolve the red precipitate seen on first mixing the two solutions. This forms the iodide of mercury, which I have used as an accelerator in conjunction with the carbonate of soda developer, made as follows:

Carbonate of soda	25 grains.
Sulphite of soda	4 "
Pyrogallic acid	2 "
Water	1 ounce.

I usually make my stock soda solution 100 grains strong, and reduce as required.

A solution of bromide of ammonium, or citrate of soda, should be kept in the dark room for use in case of overexposure, or the developer can be reduced with water to check development.

In order to succeed with this accelerator, the sulphite of soda should not be omitted. I may not have stated that fact at the meeting, as I did not think it necessary at the time, and because I had so often given my formula for the soda developer that I took it for granted every one understood what proportion of sulphite should be added to the soda.

I have had reports from quite a number, and some have succeeded satisfactorily, and others have not. Those who failed, so far as I can ascertain, have not used the sulphite in the developing solution.

The principal effect of the sulphite seems to be to prevent rapid oxidation or precipitation. Without it a precipitate is formed, and, of course, decomposition of the mercuro-iodide compound.

When a plate has been very much under-exposed, bring out as much as you can with the soda developer in four or five minutes, then drop into your graduate three drops of the mercuro-iodide solution for every ounce of developer. Pour the developer into it, so as to thoroughly mix it, and then flow over the exposed plate.

A 50-grain solution of iodide of sodium, used in the same way, acts as a good accelerator.

A 30-grain solution of iodine in alcohol, to which 40 grains of pyrogallic acid are added, makes a good stock solution for accelerating development, used the same as the other. A solution of iodine in water and iodide of ammonium will prevent any development whatever.

In using carbonate of soda, I always use the dry or granulated. The ordinary crystals are more than 60 per cent. water, which should be got rid of, so that in weighing you should weigh soda and not water. By leaving the crystals exposed to the air, the water will evaporate and leave the soda in fine powder. If you wish to expedite the evaporation, pulverize the soda and subject it to heat.—*Photo. Times.*

HEATH LODGE, HAMPSTEAD.—ROWLAND PLUMBE, F.R.I.B.A., Architect.

FINGARRY, STIRLINGSHIRE.

THIS residence, which we illustrate, has been recently erected for Mr. John Hunt on a beautiful site at the foot of the Campsie Hills. The situation commands a wide view of the surrounding country to the south and west, and the principal rooms have been arranged to take the fullest advantage of the prospect. The house is built of a warm-tinted sandstone, and roofed with sea-green slates with red ridges; and the internal fittings have had very careful attention, mantelpieces, cabinents, bookcases, etc., having been specially designed by the architect, with very successful results.

"FINGARRY," MELTON OF CAMPSIE, N. B.—JOHN B. WILSON, A.R.I.B.A., Architect.

HEREFORD CATHEDRAL. (Drawn by the late S. Read.)

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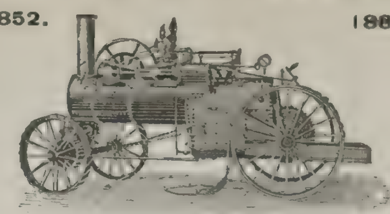

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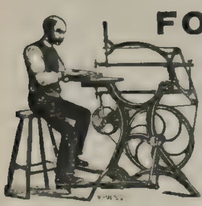

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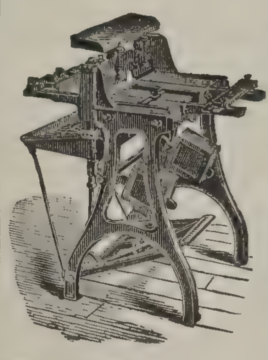

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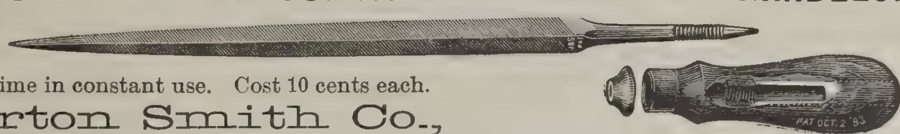

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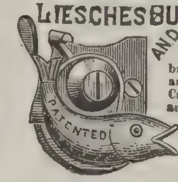

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ENGINEERING INVENTIONS.

An oscillating engine has been patented by Mr. Donia C. Putnam, of Wayne Center, N. Y. The steam inlet and exhaust ports in the cylinder and the exhaust ports in the valve may be lengthened to any desired extent to permit quicker work in engines designed for any special duty, but the travel of the valve is in any case comparatively short, on account of the rocking movement of the cylinder.

A traction engine has been patented by Mr. Benjamin S. Benson, of Baltimore, Md. It has two obliquely arranged cylindrical boilers, with their higher ends in the middle and next to each other, the space beneath the cylinders forming the firebox, with hollow legs, which communicate with the water and steam space of the boilers, and the apparatus having an endless track chain with feet passing beneath, around, and over the boiler, with guide and truck wheels for the chain, to support the body of the engine and the track upon which it runs, with various novel features for reducing friction and facilitating the guiding of the engine.

AGRICULTURAL INVENTIONS.

A grain separator has been patented by Messrs. Francis Wadsworth and Henry N. Prentice, of Venice, O. It is intended to separate the straw and chaff from the grain at the same time, and then remove the unthrashed and partly thrashed heads and heavy impurities that may have passed through the thrasher and separator with the grain.

A seed planter has been patented by Mr. Louis S. Flatau, of Pittsburg, Texas. Its construction is such that as the planter is drawn forward the hopper and a stirrer wheel are revolved, the latter forcing seed out through discharge slots into a tube, through which and the tubular plow they fall into the bottom of the furrow opened by the plow, where soil is thrown upon it by covering plows.

MISCELLANEOUS INVENTIONS.

A lemon squeezer has been patented by Mr. Sheridan S. Badger, of Chicago, Ill. It has a fixed or stationary jaw, a hinged swinging jaw, and a handle or lever, so combined that the power from the commencement of the operation continues to be increased until the operation is completed.

A fire escape has been patented by Annie M. Jeffers, of Chicago, Ill. It is a spiral structure ranged along the windows of a buildings, and containing a ladder, being stretched or opened opposite the windows, and having safety chains at such openings, and also an alarm bell.

A pipe tongs has been patented by Mr. James J. Palmer, of Fall Brook, Pa. The invention consists essentially of tongs in which the binding contact surface is composed of a number of sections, and by removing or adding links or sections the tongs may be adjusted to fit almost any sized pipe.

A nail plate furnace has been patented by Mr. Simeon Bunn, of Belleville, Ill. It has double bottoms or decks, with openings, and outer walls with openings, so arranged that the products of combustion will be carried by a long, indirect passage, and the heat will be utilized to the greatest possible extent.

A reflector has been patented by Mr. James E. McLaughlin, of Portland, Oregon. It is for gas, lamp, or other artificial lights, and is so made that four concave reflectors, spun up from rectangular sheets of metal and polished, can be conveniently kept in the desired position behind a burner.

A tag making machine has been patented by Mr. Harmer Denney, of Brooklyn, N. Y. This machine takes the paper from a roll, and by a series of automatic operations the tags are printed, cut, eyeleted, cut off, and their corners beveled, the machine being readily adjusted to make tags of different widths.

A motor has been patented by Mr. Jackson B. Miles, of Lincolnton, Ga. It is a spring motor intended for use in connection with churns to operate the dasher staff, and when wound up the mechanism works from fifteen to forty-five minutes, according to the speed at which it is allowed to run.

A tongue support has been patented by Mr. Milo M. Russell, of Hayward, Wis. The running gear of a wagon and its tongue is combined with a spring of peculiar construction, with lever and detachable connections for holding the tongue, whereby provision is made for adjusting the tension of the spring, and the whole heft is equalized.

A necktie fastener has been patented by Mr. Daniel T. Freese, of North Amherst, O. It consists of a plate slotted twice to receive the tie, and with a forked arm bent over parallel with the slotted portion to receive the collar button, the arms of the fork being at right angles with the slots of the body of the plate.

A two wheeled vehicle has been patented by Messrs. William E. Davies and William C. Gayley, of Deringer, Pa. This invention consists in making the thills in two parts hinged together, with a spring attachment, to neutralize or overcome "horse motion," and relieve the horse to some extent of the weight upon his back

A belt punch has been patented by Messrs. Henry Bouchy and J. Henry Bamberger, of Newark, N. J. It has pivoted lever jaws, with a sliding tool in each handle end, and a revolving head carrying cutting devices on one of the jaws, with a rotary disk provided with punches, making a strong, cheap, and convenient tool.

A metallic bayonet scabbard has been patented by Mr. James McKenney, of New York city. It is made with an outwardly projecting flange upon the angular side of its upper end to overlap the edge of the throg, in such manner that the connection between the scabbards and the throgs will be firmer and more secure than with the ordinary construction.

A bellows has been patented by Mr. Jacob F. Weitzel, of Cincinnati, O. It is intended more especially for bee smoking, and comprises main plates of sheet metal bent at their edges, forming grooves or pockets, while the bag or flexible portion has its edges inserted and held in these pockets, with various other novel features.

A broom holder has been patented by Mr. James F. Barringer, of Bennettsville, S. C. A U-shaped plate and rod are so combined with cross pieces and arms as to make a holder in which broom straw or rattan can be clamped, as well as bagging, cotton waste, or rope, to form a mop, and one can be easily removed and replaced by others.

A safety device for elevators has been patented by Mr. Peter Moran, of New Orleans, La. The object of this invention is to prevent the water in the tanks of hydraulic elevators from being worked so low as to empty the pipes and allow the car or cab to fall, and to this end a novel construction and combination of parts is provided.

A nutmeg grater has been patented by Mr. Albert L. Platt, of Bowling Green, Mo. It consists in a revolving barrel made of a spiral coil of steel wire having notched outer edges, combined with a block having a hole through it and a counter bole or hole at right angles, to form a case in which the spiral cylinder revolves.

A land channeling roller has been patented by Mr. Robert H. Banks, of Fort Lewis, Col. It is so made that as the machine is drawn forward plows open furrows in the ground and ribs pack or roll the bottom and sides of these furrows, while another roller rolls the surface, so as to form channels for irrigation purposes in rolled land.

A sawing machine has been patented by Mr. Daniel W. Smith, of Long Lake, Mich. The machine is attached to the log to be sawed, and then by moving hand levers up and down a reciprocating motion is imparted to the saw through a shaft and pitman, the motion of the saw being directed by a guide, while the log may be raised, lowered, or turned, as desired.

NEW BOOKS AND PUBLICATIONS.

DYNAMO-ELECTRIC MACHINERY. By Silvanus P. Thompson. New York and London: E. & F. N. Spon.

This is a second and much enlarged edition of a volume published by the same author in 1884, which was itself based on the Cantor lectures of Professor Thompson before the Society of Arts, in 1882. The rapid multiplication of forms and perfecting of details in dynamo-electric machinery which has taken place in the last four years, is well illustrated in a comparison of the facts given in the lectures of 1882 with the accumulated material that is presented in the present volume of 500 pages. Almost every kind of dynamo which has attracted any considerable attention is here described with sufficiently full explanations of details to render an understanding of its construction and operation perfectly easy, even if one has never before made a special study of the subject. A good deal of attention is given to special forms of motors and their government, and to the testing of dynamos and motors. In the appendix is a short but very interesting chapter, covering statistics and comparisons of some recent dynamos, in which the author states that "the old pattern Brush machine gave only about 59 watts per pound of copper on the armature, while the new pattern Brush armature with the same field magnets gives about 90," and suggests that "if the field magnets were remodeled, and their cores made of soft wrought iron, the number of watts per pound of copper in the armature might be raised to 200 or more, and the old 40-light machine which, as now improved, supplies 60 arc lights, might then yield current for over 100 lights." The author also notes improvements in the Gramme machine from 87 watts per pound of copper in an old machine up to 306 watts in a late pattern, and asks correspondents for further statistical information of this character, "in view of the possibility of further editions of this work being called for at a future date."

THE DETERMINATION OF ROCK-FORMING MINERALS. By Eugene Hussak. New York: John Wiley & Sons.

The authorized translation of this German work has been made by Dr. Erastus G. Smith, of Beloit College, Wis., for use more especially by the students of colleges and universities. Part I. treats of the methods of investigation, including the preparation of microscopical sections and proper polarizing apparatus, giving optical and mechanical methods, and describing the mechanical separation of rock-forming minerals, while Part II. gives an elaborate series of tables for determining minerals, accompanied by a great number of figures.

METHODS OF RESEARCH IN MICROSCOPICAL ANATOMY AND EMBRYOLOGY. By Charles O. Whitman. Boston: S. E. Cassino & Co.

This volume is intended for everyday use in the zoological laboratory, to secure uniformity in practice according to the best methods of investigation, and the proper selection of the objects of study and obtaining the most complete information in regard to them. It gives preservative and macerating fluids, dyes, fixatives, mounting media, methods of embedding, etc., with descriptions of the different instruments used and comparisons of their respective advantages.

Received.

THE SCIENCE OF MIND APPLIED TO TEACHING (According to Phrenological Methods). By U. J. Hoffman. New York: Fowler & Wells Company.

TECHNICAL VOCABULARY, ENGLISH AND GERMAN. By F. J. Wershoven and A. Van Kaven. Leipzig. F. A. Brockhaus.

THE PANAMA CANAL: ITS HISTORY, POLITICAL ASPECTS, AND FINANCIAL DIFFICULTIES. By J. C. Rodrigues. New York: Charles Scribner's Sons.

NEW YORK AGRICULTURAL EXPERIMENT STATION: Third Annual Report of the Board of Control, for 1884. Albany, N. Y.: Weed, Parsons & Co.

IOWA STATE BOARD OF HEALTH: Third Biennial Report, for fiscal period ending June 30, 1885. Des Moines: George E. Roberts.

CONSPIRACY. A Cuban Romance. By Adam Badeau. New York: R. Worthington.

A FARMER'S VIEW OF A PROTECTIVE TARIFF. By Isaac W. Griscom. Published by the author, Woodbury, N. J.

Business and Personal.

Any person having a new invention may, without charge, consult MUNN & CO., Scientific American Office, 361 Broadway, New York, for advice how to obtain a Patent or Caveat. Our Hand Book of Instructions relating to Patents sent free.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Minerals sent for examination should be distinctly marked or labeled.

(1) P. H. desires a stain to imitate cherry. A. Rain water 3 quarts, annatto 4 ounces; boil in a copper kettle till the annatto is dissolved, then put in a piece of potash the size of a walnut; keep it on the fire about half an hour longer, and it is ready to bottle for use.

(2) W. C. writes: In making a red or yellow stain with dragon's blood or turmeric, I want to tone these colors with a black, soluble in alcohol. A. You can probably purchase an aniline black that is soluble in alcohol, or else use logwood.

(3) F. F. K.—Old zinc battery plates can be melted in an iron pot and cast into plates in moulding sand, or may be cast in an iron mould. Zinc melts just below a red heat. If the zincs have been amalgamated, you should avoid inhaling the fumes rising from the heated metal.

(4) J. W. B. desires a recipe for some fire-extinguishing liquid. A. One of the best solutions for the extinction of incipient fires consists of crude calcium chloride 20 parts, salt 5 parts, dissolved in water 75 parts. Keep at hand, and apply with a hand pump.

(5) E. E. G. asks how to make a leaf bluing. A. Use unsized paper and any of the following solutions: 1. Dissolve indigo sulphate in water and filter. 2. Dissolve good cotton blue in cold water. 3. Dissolve Prussian blue with one-eighth part of oxalic acid in water. 4. Dissolve Tieman's soluble blue in water with 2 per cent oxalic acid.

(6) A Subscriber asks how to make spirit varnish suitable for varnishing carved wood. A. Take 1 ounce copal and ½ ounce shellac; powder them well, and put them into a bottle or jar containing 1 quart alcohol. Place the mixture in a warm place and shake it occasionally until the gums are completely dissolved; and when strained the varnish will be ready for use.

(7) C. J. C. asks: What is cut glass, such as is sold by dealers? A dealer here has two berry dishes that look alike, prices $1.00 and $20.00. One he calls cut glass and the other an imitation, with rough surface. A. Any glassware that has been ground in facets and repolished is cut glass. The kind that you sketch is very expensive when cut.

(8) W. A. E. asks how India ink (liquid), such as is sold in the art supply stores, is made. A. Dissolve shellac in a hot aqueous solution of borax and rub up in this solution a fine quality of India ink. Or rub down genuine India ink with good black ink until it will flow easily from the pen. See ink erasers, in article on inks, in SCIENTIFIC AMERICAN SUPPLEMENT, No. 157.

(9) F. C. E. asks how to make a mould from which he can get one or two dozen castings in tin or its soft alloys. A. You may make a mould of iron or brass for casting tin or soft alloys. Plaster of Paris moulds will allow of a few castings, but are brittle and not reliable. If the mould can be cut easily, it can be made of soapstone.

(10) W. V. L. asks: Is it true that gold is one of the constituent parts of silver? A. Both gold and silver are elements, and theoretically are free from all admixture. In commerce they are generally alloyed with some harder elements. In mining, gold ore often yields a good proportion of silver.

(11) J. M. L. G. asks: 1. What is about the cost of the least complicated and plainest (and therefore the cheapest) lathes in the market? Also planer of the same description. Both to be durable and strong, for working iron. A. The price of lathes and planers varies so widely that it is impossible to name a price without knowing the size. A new or second hand lathe for iron work may be anywhere from $50 to $500. Planers about the same. Address makers and dealers who advertise in our columns for their lists of new and second hand machinery, stating about the size you want. 2. Is it injurious to slightly oil or grease boilers at night when quitting work? A. There is no harm in oiling the outside of your boiler. 3. Do the safety plugs (in the crown sheet) ever melt out when properly filled with metal, when well covered with water? A. Safety plugs have been known to melt by too hard firing with a thin sheet of water over them. Otherwise they are generally reliable.

(12) A. E. L.—Oberlin College, Ohio, Cornell University, Ithaca, N. Y., are institutions where part of the dues are taken in labor. We do not know of any institutions that provide for students wholly earning both board and tuition, but with the $300 you have saved, some knowledge of the machinist's trade, and plenty of pluck, we do not doubt you can get about as thorough a course as you may resolve upon.

(13) M. I.—Lignite may be readily pressed in bricks for burning, by the addition of a little tar or fluid pitch or asphalt. Crude oil does not dry readily, and might not be found practicable. Presses for this work are made in Pennsylvania.

(14) G. E. B. asks: Of what value would a knowledge of the process of hardening copper be to any one at the present time? A. Such a process would be very valuable if it can be done after the copper has been worked to shape or combined with other metals, as the linings of pump cylinders, hydraulic rams, and pistons, and for a thousand uses in running machinery. The hard alloys of copper are well known.

(15) F. W. asks the simplest way to tell how much a block and fall will safely carry. Also, how many men it would take to lift a certain weight with a 2 and 3 sheave block, and the difference with 3 and 4 sheaves and blocks; also, if ropes are measured round or through, and if there is a book on ropes and knots. A. With a pair of blocks of 2 and 3 sheaves respectively, you will have a leverage of 5 to 1, less the friction. With a pair of blocks of 3 and 4 sheaves respectively, the leverage will be 7 to 1, less the friction. New ropes will bear from 1,500 to 2,000 pounds as a safe load per square inch of section. A rope of 1 inch diameter will have ¾ of an inch section, and may be used for from 1,200 to 1,500 pounds load. Ropes are sold by their size in circumference. Thus a 3 inch rope is 0·95 inch diameter. A 2½ inch rope will be a little over ¾ inch diameter, etc. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 396, Rope Strains.

(16) T. H. G. writes: I have a mahogany table which has been varnished and has ink spots on it. 1. By what means can I get the varnish and ink off, in order to rub on an oil finish? A. The ink spots can be washed off with water and the varnish with alcohol. 2. What is best to polish carved brass? A. Polish with rotten stone and oil, alcohol, or spirits of turpentine. 3. What will remove water stains from polished marble? A. Mix quicklime with strong lye, so as to form a mixture having the consistency of cream, and apply it immediately with a brush. If this composition be allowed to remain for a day or two, and be then washed off with soap and water, the marble will appear as though it were new.

(17) F. A. C. desires a receipt for a harness cleaner and oiler. A. Take 2 ounces mutton suet, 6 ounces beeswax, 6 ounces powdered sugar candy, 2 ounces soft soap, and 1 ounce indigo or lampblack. Dissolve the soap in ¼ pint of water, then add the other ingredients, melt and mix together, add a gill of turpentine, lay it on the harness with a sponge and polish off with a brush.

(18) C. H. B.—The coarse emeries are sifted. You may buy sieves of brass for grades down to No. 80 or 90. After that, wash by placing the emery in a basin, pail, or tub, according to the quantity you wish to wash, with a small pipe attached to a hose from a water supply, and a faucet to regulate the flow; stir the emery at the bottom of the pail with the hose nozzle, allowing the water and fine emery to run over the side of the pail into a pan larger than the pail, and, if necessary, continue the overflow into two or three pans. The different pans will catch different grades of emery. Your own judgment and a little tact must be used in regulating the flow of water.

(19) L. S. P.—Height of Washington monument, 555 feet. The depth that a body sinks in sea water depends upon its density. Sea water weighs 64·312 pounds to a cubic foot, while fresh water weighs 62½ pounds to a cubic foot. From this a comparison of the floating capacities may be estimated. All bodies heavier than water go to the bottom at once, even to the greatest depths. The greatest depth yet reached is about 23,000 feet. See SCIENTIFIC AMERICAN SUPPLEMENT, No. 398, for illustration of deep sea sounding apparatus. 6,000 to 10,000 pounds per square inch is the greatest hydraulic pressure we have heard of being used; 4,000 to 6,000 pounds per square inch in common use.

(20) C. B. writes: 1. I have an iron wash sink with a common trap and ¾ inch waste pipe leading to a cesspool in yard. When water is thrown in the sink, it does not run off readily; a pint would take two or three minutes, but, by lifting up the trap (strainer), the water bubbles up two or three times and then runs down all right. What is the trouble? A. The sink pipe is air bound, and the bubbling is caused by air escaping. The pipe should be ventilated between the trap and sink; vent should be outdoors. 2. What is sweet oil made of? A. Sweet oil is the oil of the olive, which grows in Spain, Italy, etc. 3. What is celluloid? A. The manufacture of celluloid, parkesine, and zylonite are described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 227. 4. Does the word "Redditch" on needle labels stand for the maker's name? A. Redditch is a trade mark. You may obtain prices through the jobbing trade in your city.—The sample you ask about is called pebble cloth, made by passing it through embossed calenders. Mastic varnish is proper for it.

(21) W. B. H. writes: Have you a recipe composed of linseed oil and resin, mixed, to make muslin semi-transparent and waterproof? A. Dissolve together white resin pulverized 8 ounces, bleached linseed oil 6 ounces, white beeswax 1½ ounces; add the turpentine while hot. Apply to both sides of the cloth while it is stretched tight. 2. How are the yellow oil proof coats made? A. The yellow jackets referred to are made by treating the cloth with a solution made by dissolving 1 ounce beeswax in 1 pint best linseed oil over the fire, applying it, when cold, with a piece of rag, rubbing it well in and then drying.

(22) S. G. W. writes: Sam Jones, the noted revivalist, is trying to make people believe that 13 worlds have been lost sight of by the astronomers, and it is a sure sign that one world or planet will soon be destroyed. Give your opinion. A. We do not think it follows that the stars referred to have been destroyed because they have been lost sight of. Astronomy cites many instances of stars appearing in the heavens attaining a high magnitude and then suddenly disappearing again. In some cases these phenomena have been observed to be periodic. We do not see that the destruction of the earth follows by analogy.

(23) J. J. W. asks: 1. The ingredients for a good water stain to imitate walnut? A. Burnt umber 2 parts, rose pink 1 part, glue 1 part, water sufficient; heat all together and dissolve completely; apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac. 2. A good jet black water stain. A. Pour 2 quarts boiling water over 1 ounce of powdered extract of logwood, and when the solution is effected 1 drachm of yellow chromate of potash is added and the whole well stirred. When rubbed on wood, it produces a pure black. 3. A good size for gilding with gold leaf, one to be ready for gilding in an hour. A. Good drying oil 1 pound, pure gum anime powdered 4 ounces. Bring the oil almost to the boiling point in a covered metal pot, add your gum gradually and cautiously to the oil, stirring all the time to dissolve completely. Boil to a tarry consistency and strain, while warm, through silk, into a warm bottle with a wide mouth. Keep it well corked; use as required, thinning with turpentine. 4. The compositition of the so-called oil finish? A. Boiled linseed oil 1 pint, yellow wax 4 ounces; melt and color with alkanet root.

(24) H. N. S. asks: Which is the faster—a toboggan or a sled (steel shod); assuming that the total weight is the same in each case, the incline of the coast the same, and each on a coast best adapted to it? Also, the reasons governing your reply. A. We should say the steel shod sled. Although the frictional resistance is independent of the area of contact (so much larger in the toboggan than in a sled) or the velocity of rubbing, and the intensity of pressure is the same, yet the rubbing surfaces of the toboggan present more asperities to interlock with those of the ice or snow than do the steel runners of a sled. Bodies having rough surfaces, those made of compressible material, and those of irregular surface and form exhibit greater friction, as these features are exaggerated.

(25) N. N.—Art work is so various in its specialties that we cannot venture on specific names without knowing what you should know, viz., what your taste leans to in art study. When a young man arrives at the age suggesting a feeling of responsibility, he should at once consult with his friends or those that know his habits, opportunities, and proclivities, as to the probability of his success in any trade or art that presents itself to his grasp. We believe that you have an excellent library in your town in which are to be found books on the trades and arts. Join it and read.

(26) C. R. asks whether successive coats of glue, applied hot to wood or articles of a woody nature, would permeate the material, giving it toughness and rigidity, or would said glue remain as a mere coating, not permeating? If the glue would not materially permeate, what would you suggest as a fluid that would permeate and produce rigidity and, at the same time, have a preserving quality? It is desired that the article should be very cheap and the process very simple. A. Glue will not penetrate wood sufficiently to affect its stiffness or rigidity. Boiling the articles in thin glue for a few minutes will allow the glue to penetrate slightly further than the mere brushing of the hot glue upon the surface. Whatever can be forced through the grain endwise, that would dry easily and of a glutinous nature, would stiffen the work. These processes are tedious and expensive.

(27) J. M. D. asks: Is there any virtue in the "divining rod," so called, as a means of determining the locality of hidden streams of water? A. None whatever. The bobbing of the stick is due to a muscular pressure by the holder.

(28) T. E. writes: I have a marine boiler in use on a steamboat that gives plenty of steam, but the motion of the engine (12 inches in diameter, 5 feet stroke) raises the water in said boiler at least 4 inches. There is a steam drum on top of boiler about 18 inches diam. and 24 inches high. Would an additional steam drum connected horizontally to top of drum now on boiler, with a three inch pipe, prevent the raising of water when the engine is in motion? If so, how large a drum would be necessary? Would this additional drum save fuel? My steam pipe is 3 inches. A. The additional steam drum will not help you. It will only add to the work of the boiler by condensing the steam. If your steam pipe and drum is naked, it should be felted. The raising of the water is, no doubt, a surging of the surface into waves by the action of the engine, which shows in the water gauge. This may be partially prevented or broken up by making another connection near the end of the boiler, between the boiler and the steam pipe, with a 2 inch or 2½ inch pipe. This will partially relieve the water under the dome from the reciprocating action of the engine. Felting the exposed parts of the boiler is also necessary to economy.

(29) L. H. R. writes: In a hydraulic ram for making lead pipe the water ram is eaten with grooves running vertically with the ram. This caused the water to leak so badly, I had a new ram cast. I now notice small grooves beginning in the same manner, which, in less than a year's time, will compel me to get another new ram, unless the evil is remedied. What is the cause? What is the remedy or preventive? The water used is from the Kansas River, and is not filtered; but if the cause was from sand or any gritty substance, it surely would ruin the leather packings before it would eat away the ram. A. The ram pistons in the lead pipe presses in New York and vicinity have a life of only about one year, wearing in grooves as you describe. The present practice is to cover the pistons with copper, which wears two to three years. Old pistons are also covered and recovered. If you have the old piston, you can have it covered. Gritty substances, as fine sand, iron rust, the hardening of the leather by absorption of iron, together with the great pressure, is the assigned cause of the cutting.

(30) C. R. desires a simple size for making decalcomanie or transfer paper. A. Use gelatin size. 2. Could I bake in a japan oven so that the transferred printing could be drawn slightly, like a blacking box lid? A. If the picture is coated with a transparent japan varnish, it can be baked same as any other varnish. If the japan is quite thin, the metal may be drawn.

(31) H. L. writes: 1. I wish to melt a gold coin in a sand crucible, and want instructions how to proceed. A. Break into small pieces, mix with borax, and expose it in the crucible. 2. Is there danger of heating too hot? A. No. 3. Can I remedy its tendency to crack? A. Only by proper annealing. 4. I have seen gold coin as yellow as brass and some almost as red as copper. What is the cause of so much difference in color? A. The red color is due to its being alloyed with copper. The natural color is yellow, but it becomes red by the addition of copper. See "The Practical Gold Worker," by George Gee, which we can send for $1.75.

(32) J. G. H.—We could not recommend a steam pump to be used once a fortnight. It would never be in order for running. A small low pressure steam pump in the market will cost about $125. We consider gasoline a dangerous element in its liquid state, in the vicinity of fire. Its vapor, mixed with air, as used for lighting purposes, where the vaporization is carried on outside of the premises, will be safe if burned in jets in a stove.

(33) J. C.—A first class ice boat, sailing on first class ice, will sail from three to four times faster than the wind that drives the boat. For example, a wind having a velocity of fifteen miles an hour will drive the boat at the rate of from forty to sixty miles an hour.

(34) W. H. O. desires a formula for making white miners' oil, for burning in lamps. A. Take 50 to 60 per cent mineral, seal, or some other 300° oil and from 40 to 50 per cent of pure lard oil. A cheaper article is made by using 40 to 50 per cent cotton or rape seed oil.

(35) E. W. asks: What is a good, cheap substitute for beeswax to coat wooden patterns for use but a few times, something that can be applied with a brush, without heat? A. Shellac varnish. 2. What is a good flux for welding iron in a blacksmith's fire, and the desirable qualities of coal for same? A. Clear white sand or borax. Use best Cumberland coal, free from sulphur.

(36) J. C. writes: I am burning in my boiler slabs that are saturated with salt water, and find that the tubes of the boiler have to be cleaned out every few days on account of the salt, which is coated heavily upon them. Is there any danger of the salt eating into them or doing any injury? A. The burning of salt fuel under boilers may not materially affect the iron while the boiler is in use, but may make a coating or form a coat upon the surface of the tubes by the condensation of the evaporated salt that will be troublesome to clean off. When the boiler is not in use, the salt crust will absorb water and rust the tubes. A close examination of the rear end of the boiler and tubes will show whether the tubes are accumulating a crust that the tube brush does not remove. If so, better abandon the use of salt fuel. The dry salt does not affect the iron. The salt absorbs water when the boiler is cold, when rust takes place.

(37) J. S.—Cast or tool steel cannot be welded together with any certainty. Low grade steel that will harden, such as shear and double shear, can be welded together fairly with borax and sal ammoniac or borax alone, which are also good for welding steel to iron. Use about one-tenth sal ammoniac, pulverized with the borax and heated to evaporate the water, then pulverize again and weld with the powder.

(38) E. M. asks (1) what to add to hair oil that will give the hair a yellow color. I have very light hair, and would like to color it a darker shade. A. A bismuth hair dye is described in SCIENTIFIC AMERICAN SUPPLEMENT, No. 356, which is not considered injurious at all to the head. 2. Give me a remedy to purify the blood. A. We would refer you to a physician for a remedy of this character. 3. A good toilet soap. A. See "The Manufacture of Toilet Soaps," contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 518 and 519.

(39) P. M. A. asks: Would you please give some remedy whereby tattoo marks may be completely expunged? A. We know of no means by which they can be completely removed. Pricking in milk, in some cases, rather fades them.

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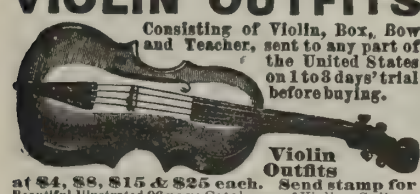

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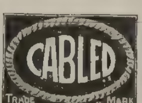

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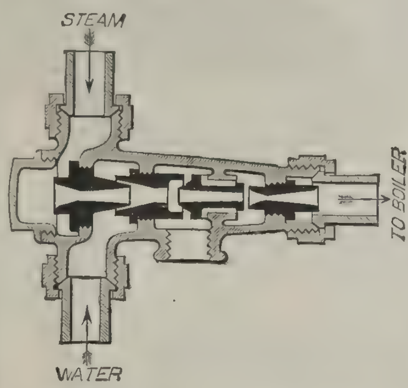

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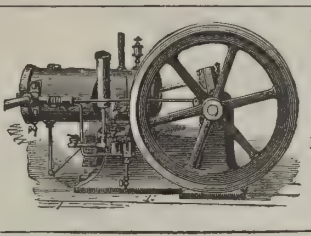

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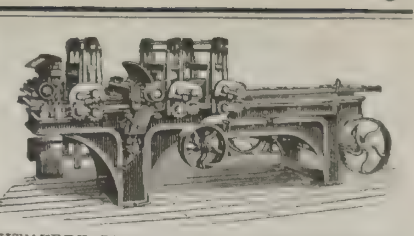

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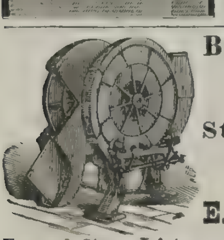

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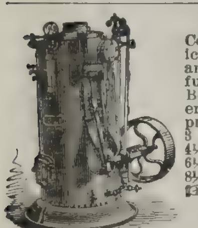

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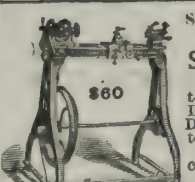

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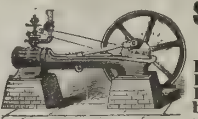

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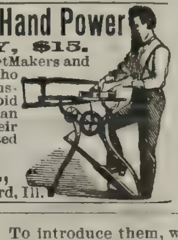

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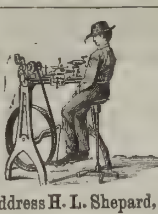

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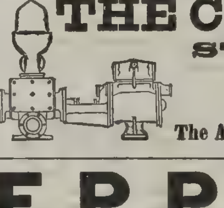

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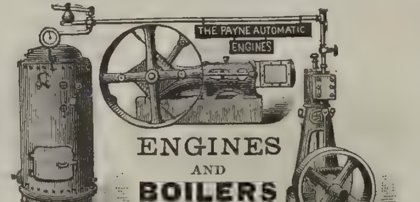

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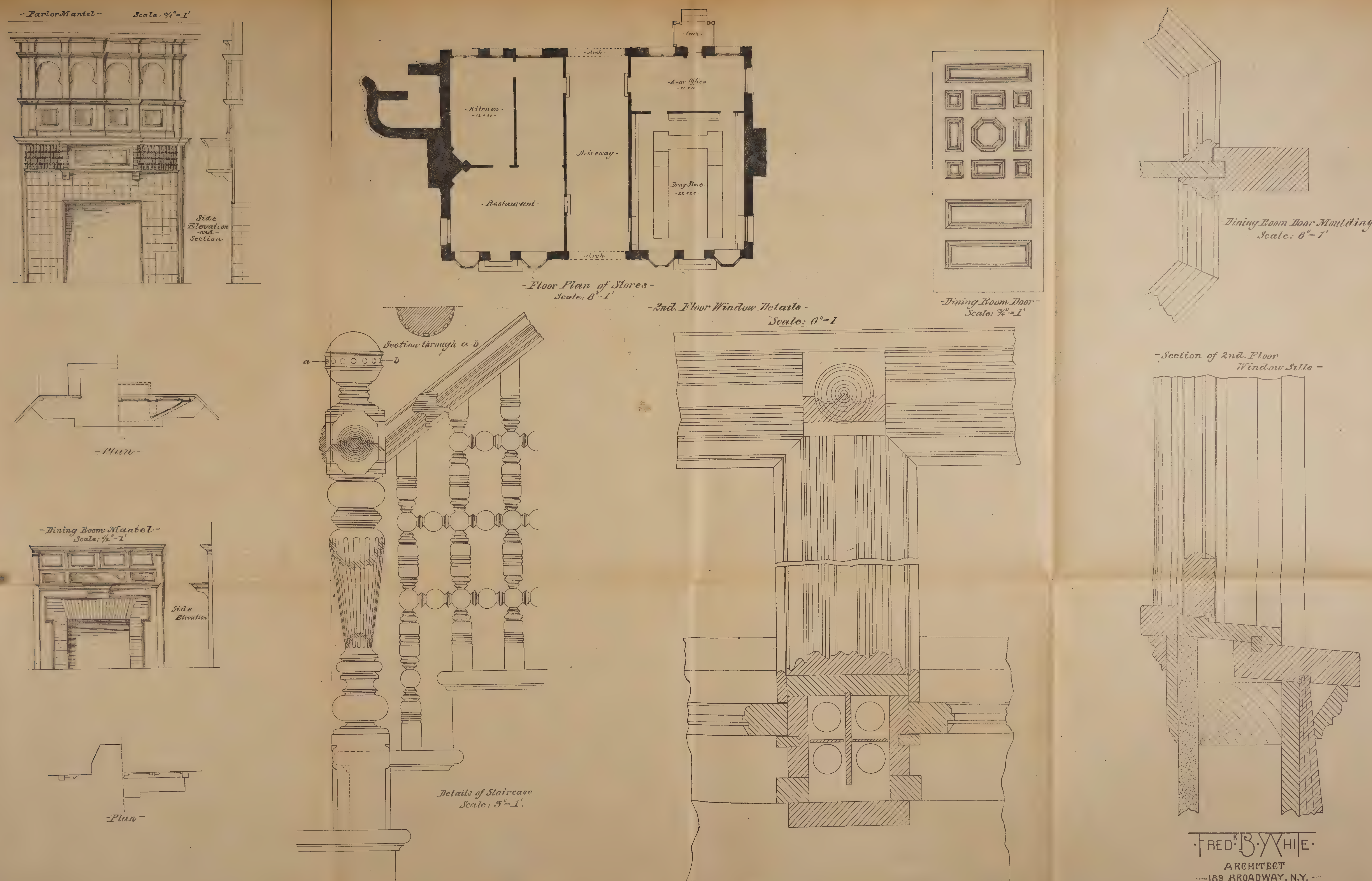

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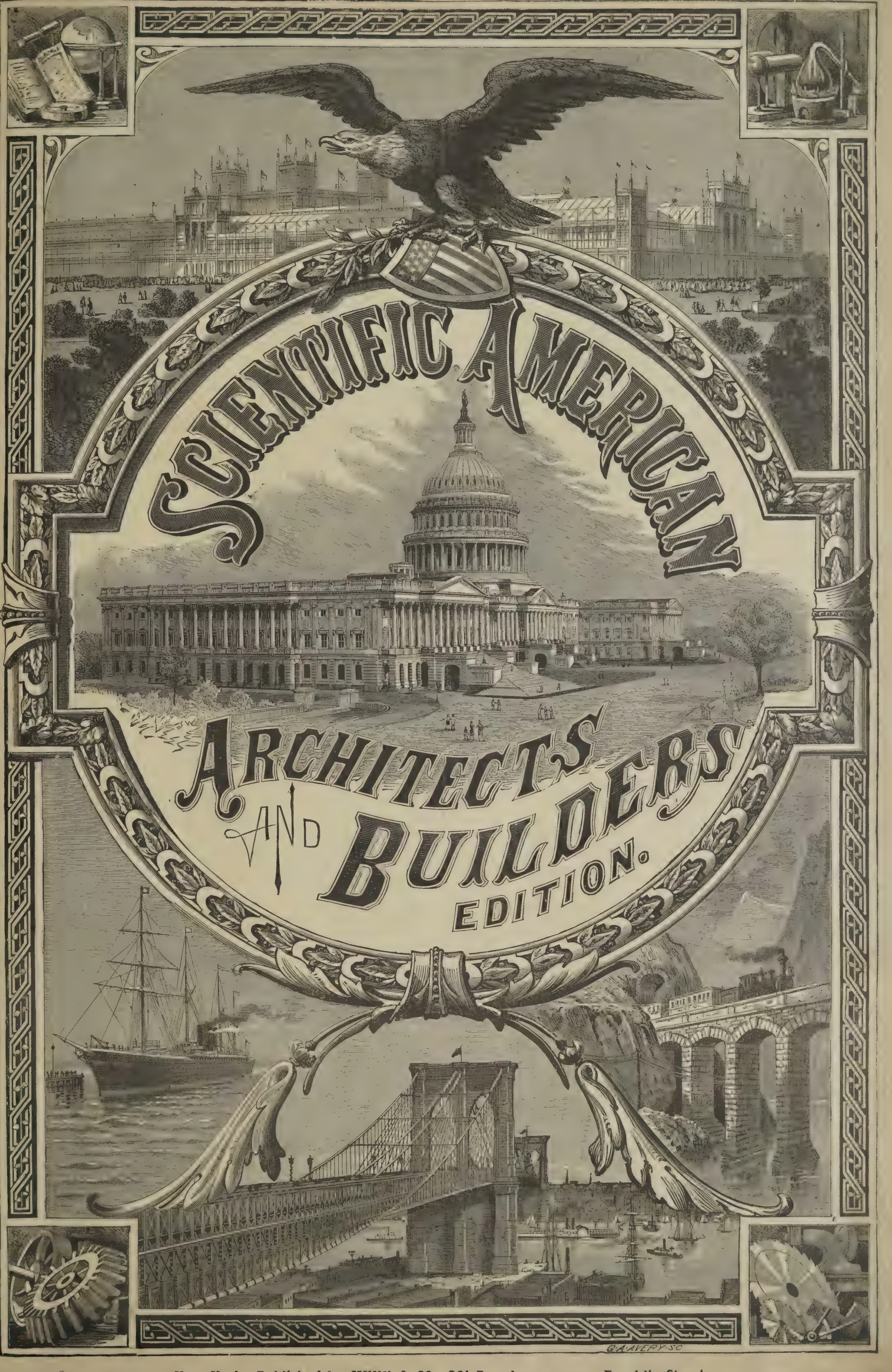

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The dredge shown in the accompanying engravings is the seventh one built by the American Contracting and Dredging Company of this city for work upon the canal; it differs from the previous ones mainly in the substitution of iron for wood in the tower, derrick, and ladder, and in having greater height of tower, greater length of ladder, and increased boiler power.

The composite hull of yellow pine and iron is 116 feet long, 36 feet wide at the after end, and 30 feet wide at the forward end; the sides are curved to a radius of 106 feet. The end of the hull, which is 12 feet deep, is rounded to a radius of 11 feet. In the forward end of

Fig. 1.—THE GREAT DREDGE AT WORK.

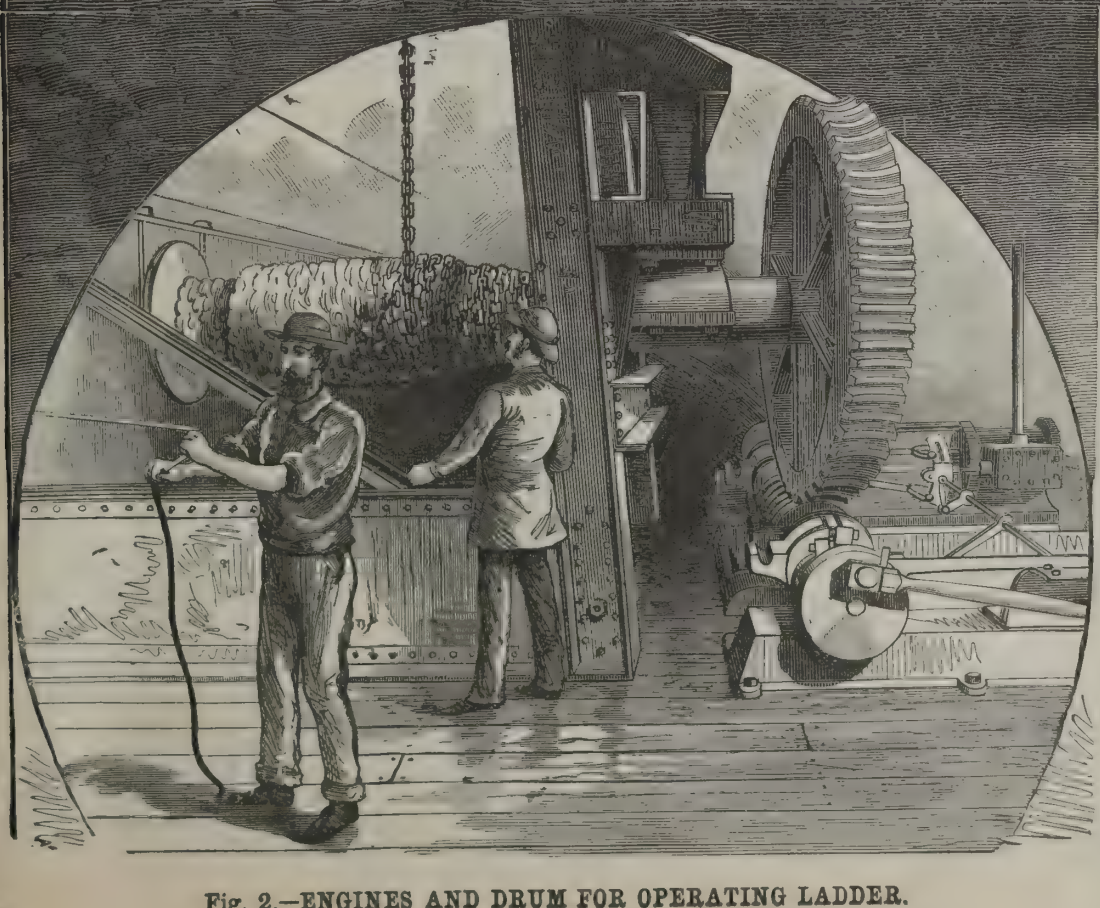


Fig. 2.—ENGINES AND DRUM FOR OPERATING LADDER.

the hull is a slot, in which the ladder moves, 36 feet long and 7 feet wide.

The two wooden spuds are 24 inches in diameter and 60 feet long, and are provided with iron chisel points weighing 1,800 pounds. Each spud passes completely through an opening in the hull, in which is vertically placed a cast iron tube, the interior of which is double-coned shaped, the diameter at the center, where the bases of the cones meet, being 25 inches, and the diameter of the ends 27 inches. This gives the spud a center bearing, and prevents binding during raising or lowering.

When working, the dredge is held by either spud being lowered. The spuds are handled by means of ⅞ inch chains passing through double sheave blocks to a drum operated by a pair of engines 8½ inches diameter by 12 inches stroke. A pinion on the engine shaft, which is 4 inches in diameter and 3¾ feet long, engages with a gear on the drum shaft.

From the inside of the bottom of the hull to the top of the tower is 70½ feet. The tower consists of six posts converging toward the top and arranged in two sets across the hull. The rear set is made up of 12¼ inch, and the forward set of 15 inch latticed channels, the whole being united by latticed channels and diagonal rods. The platform at the top, which is 38 feet long by 24 feet wide, rests upon three iron beams running longitudinally and supported upon the posts.

The outer parts of the platform are held by inclined braces attached to the sides of the tower. Two bars 1 by 2½ inches and 25 feet long extend from the bottom of the top panel of the tower to the extremity of the stern, and two bars 1⅛ by 4½ inches and 38⅝ feet long extend from the front of the

THE GREAT DREDGER OF THE PANAMA CANAL.

same panel to the stern. The bars support the tower against the strain of the bucket ladder. Each side of the tower is braced by latticed channels united by horizontal and diagonal members, and converging toward the side of the boat. Two plate keelsons 36 inches deep extend from the rear of the foot of the tower to the foot of the derrick, as shown in Figs. 2 and 3. The derrick is 80 feet long, and is made up of latticed channels 12¼ inches, united in the same manner as the tower. Two bars 1⅜ by 4½ inches extend from the top of the derrick to the bottom of the upper panel of the tower. The ladder is made in two sections jointed together, the upper part being 73 feet 10 inches long and the total length 115⅝ feet. The ladder is made of 4 by 6 inch angles joined by a web 24 inches deep and ⅜ inch thick, and each section is stiffened by a truss upon the under side.

The links of steel chain carrying the buckets, which are made of five-eighth inch steel and have a capacity of one cubic meter, are 3 feet long and 1⅝ by 7 inches in section; to every alternate link is attached a bucket placed between two links. All parts of the chain are made interchangeable to facilitate repairs. At the top of the tower the chain passes over a square tumbler, mounted on a shaft 14 inches in diameter and 17 feet long, and having chilled cast iron corners bolted between flange heads, so that they may be easily replaced when worn out or damaged. The chain passes under and over a six-square idler on the lower end of the ladder.

The chain is operated by engines 16 by 24 inches. The driving pulley is 10 feet in diameter and 38 inches face; the belt extends to a smaller pulley mounted in the upper part of the frame, and connected by gearing with the tumbler shaft.

The ladder is raised and lowered by means of a chain attached to a bail near the end of the ladder, then passed over a pulley near the top of the derrick, then under a pulley on a bail pivoted to the end of the ladder by the same bolt that holds the idler, and then over a pulley at the extremity of the derrick, and finally to a drum operated by 8½ by 12 inch engines. At the center of the engine shaft is a worm meshing with a gear on the drum shaft, as shown in Fig. 2.

The buckets empty into a bell of an iron chute, 3 feet in diameter and 180 feet long, and supported as shown in Fig. 1. To aid the discharge of material, when necessary, two pumps, 10 by 14 by 14, discharge water into the chute.

The engines are all double, and are link motion. Steam is supplied by three boilers—locomotive pattern —6½ feet in diameter and 23 feet long, and of 100 horse power each. Exhaust steam is conveyed to a surface condenser. All the machinery is operated from one room located on deck, just forward of the center of the boat.

These dredges are known as the endless chain.

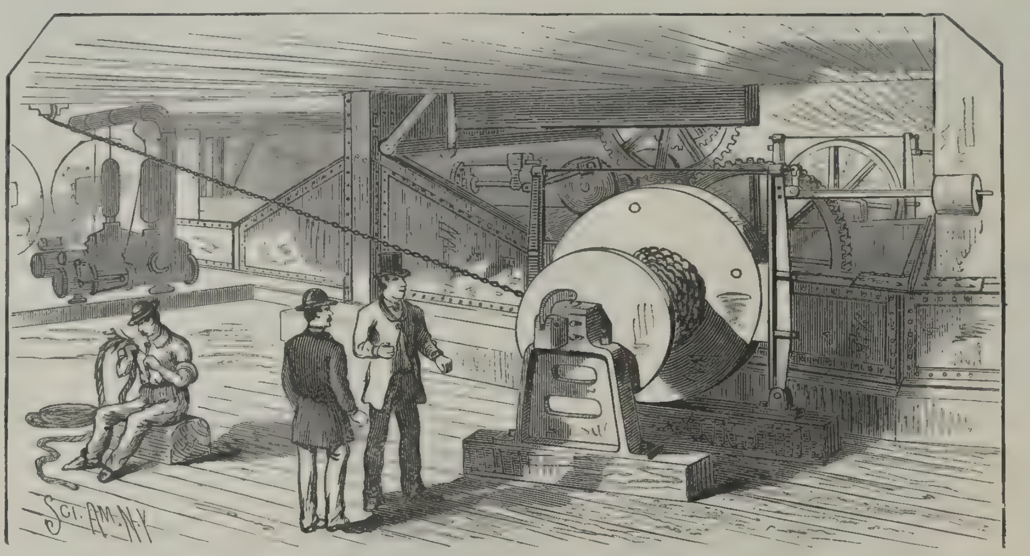


Fig. 3.—ENGINES AND DRUMS FOR OPERATING SPUDS.

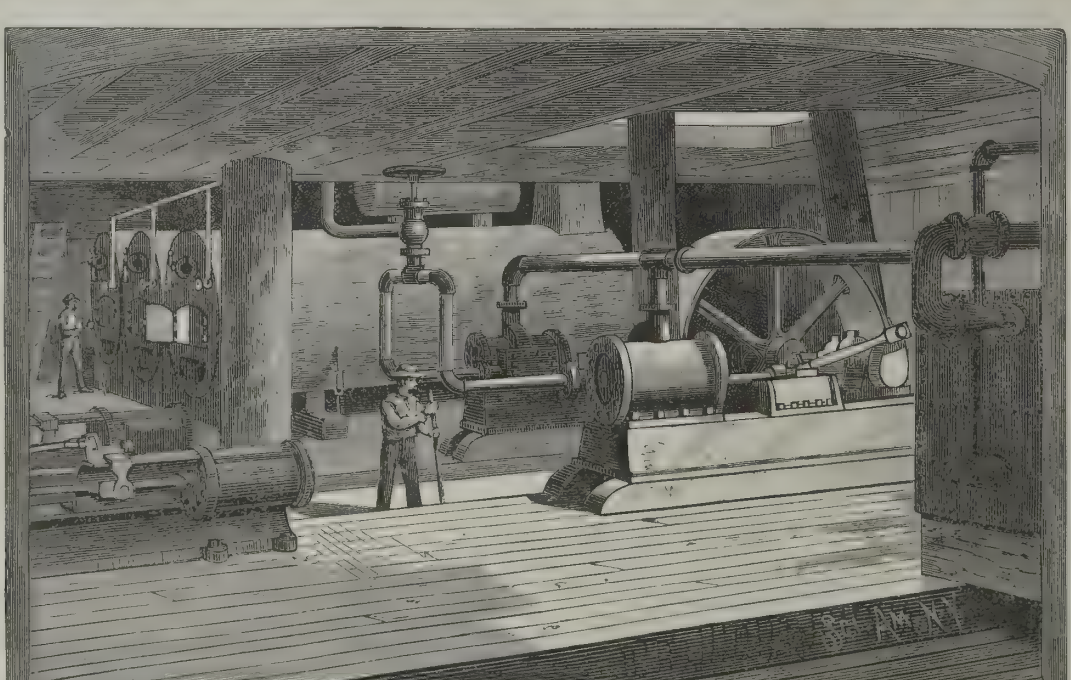


Fig. 4.—MAIN ENGINES, BOILERS, AND CONDENSER.

The Pike's Peak Railway.

The Pike's Peak Railway, which is expected to be in operation this year, will be the most notable piece of track in the world. It will mount 2,000 feet higher than the Lima & Oroya Railway, in Peru. It is now in operation to a point over 12,000 feet above the sea level. The entire thirty miles of its length will be a succession of complicated curves and grades, with no piece of straight track longer than 300 feet. The maximum grade will be 316 feet to the mile, and the average grade 270 feet. The line will abound in curves from 500 to 1,000 feet long, in which the radius changes every chain.—*American Railway Journal.*

THE London *Times* states that an air balloon railway is about to be constructed on the Gaisberg, near Salzburg, a mountain of no great height, but offering a magnificent view over the environs of the town. The balloon, which will have grooved wheels on one side of its car, will ascend a perpendicular line of rails.

Congo Red.

The following methods for using Congo red are given by Prof. Egb. Hoyer in the *Wochenschr. d. Pol. Ver.:*

This coloring matter is specially adapted for cotton, linen, jute, etc. Cotton is dyed with two per cent dyestuff, without mordant, in a bath of boiling water, in which it is left for two hours, then washed and dried. After drying, the cotton is treated in a soap bath, containing 4 to 5 per cent soft soap, in which it is left until the shade is perfectly clear, the shade obtained being similar to a Turkey red, with a yellow shade.

Cotton yarn and piece goods are dyed the same as cotton, but are not dried before soaping, being soaped directly after washing. Some kinds of cotton get better dyed with the help of a mordant, and a solution of 1 per cent alum and 4 per cent borax can be added to the dye bath, the proceeding being the same as above.

The property possessed by this coloring matter of dyeing cotton in a water bath renders its application possible also for mixed goods, the wool being first dyed in any desired shade, and the cotton is then dyed with Congo red dissolved in water.

Another method is the following: Dissolve for 50 pounds cotton wool, 1 pound 8 ounces stannate of soda in the dye kettle; add 2 pounds potash soap, raise to boil, and scum the bath. Then add to the bath 1 pound Congo, and when this is well dissolved enter cotton; boil for two hours, and leave in the bath overnight. Pass, then, the cotton through the hydro-extractor. This same method gives very good results also on cotton yarn. It is better to dye with this coloring matter at boiling point, in order to increase the fastness of the shades against light.

Advertising in the London "Times."

Somebody has calculated that the advertisements in a recent Saturday issue of the London *Times* brought in about $11,000. This would make $66,000 a week, $264,000 a month, and $3,168,000 a year. The number consisted of 24 pages, and of these 14 were filled with advertisements. This is larger than the average number, and the total income for a year from the advertising is probably not more than three-fourths the above sum, or nearly $2,500,000 a year. What the expenses of the paper are, nobody but the proprietors and two or three others know. The highest estimates have, however, never exceeded $25,000 a week, or one-half the probable receipts.

Heat Becoming Dark with Great Intensity.

Mr. W. Gadd, of Manchester, Eng., writes as follows to the *Journal of Gas Lighting:*

The account of M. Felix Lucas' experiments opens up the higher studies of heat and combustion, which have been the subject of inquiry by scientific investigators for many years past. I do not desire in any way to detract from the originality or merit of M. Lucas' work in saying that his conclusions are corroborated by earlier inquiry. As long ago as 1876 I was able to obtain from the burning of oil, under steam blast, first the white, then the gray, and lastly the invisible flame. And from a paper I read about that time, I append the following printed extract bearing on the subject:

"It has been calculated that if we increase this speed of vibration to about five millions per second, we are again made conscious of the same in the form of a faint heat emanating from the object, and that at about four hundred billions per second light commences—first a deep red, then (with further increase of speed) yellow, green, blue, and lastly violet. As these lights develop, however, with the speed, the heat at first felt fades away, and, like sound at a lower rate of motion, ceases to operate as such. If we follow the results of a further increase in speed, we find that when we reach about eight hundred billions per second all light ceases, just as if no motion whatever were in operation —in manner like unto sound and heat. It thus appears that we may consider the *modes* of motion as simply differences in speed, and that what we know as chemical action, electricity, and even life itself, are, on ultimate analysis, merely varying rates of the one all-pervading energy or motion of the particles of matter under consideration."

The difference in order of disappearance of light and heat is only apparent, as a consequence of being described from the mechanical standpoint, and is chiefly interesting as showing that the knowledge is not new, although the present contribution on the part of M. Lucas is extremely valuable. Personally, I do not lay any claim whatever in the matter, other than to a partial demonstration, in experiment, of a theory which had, previously to the date given, been repeatedly propounded.

My Boy, do You Smoke?

The United States Navy annually takes into its service a large number of apprentice boys, who are sent all over the world and taught to be thorough sailors. It has been the policy of the government since the war to educate the "blue jacket," upon the principle that the more intelligent a man is, the better sailor he is likely to become. There is no lack of candidates for these positions. Hundreds of boys apply, but many are rejected because they cannot pass the physical examination. Major Houston, one of the Marine Corps who is in charge of the Washington Navy Yard barracks, is the authority for the statement that one-fifth of all the boys examined are rejected on account of heart disease.

His first question to a boy who desires to enlist is: "Do you smoke?" The invariable response is, "No, sir," but the tell-tale discoloration of the fingers at once shows the truth. The surgeons say that cigarette smoking by boys produces heart disease, and that in ninety-nine cases out of a hundred the rejection of would-be apprentices on account of this defect comes from excessive use of the milder form of the weed. This is a remarkable statement, coming, as it does, from so high an authority and based upon the results of actual examinations going on day after day, and month after month. It should be a warning to parents that the deadly cigarette is sure to bring about incalculable injury to the young. A law passed restricting its use to the dudes would not, perhaps, bring popular disfavor, because it might reduce the number of these objects about our streets, but boys indulging in the cigarette ought to be treated to liberal doses of "rod in pickle" until the habit is thoroughly eradicated.

ST. PAUL'S CATHEDRAL, LONDON.—DRAWN BY S. READ.

THE NEW YORK FIRE DEPARTMENT.

Although the single swing of a pendulum only measures a second of time, yet each one of these periods may be so intimately and directly connected with events of such vital interest as to become of the greatest importance. It is doubtful if there be any moment, in any calling, in which so many movements bearing immediately upon the result are crowded as in the fire department when an alarm is received. The ease with which an incipient fire can be extinguished, and the fearful rapidity with which it spreads and gets beyond control, compelled the adoption of every device and method that would in any way lessen the time intervening between the alarm and the arrival at the fire. Consequently each fraction of a second is carefully guarded lest it escape before having seen the performance of some step tending toward the accomplishment of the main object. The seeming confusion, the apparent mixing up of men, horses, and machinery, is the outcome of persistent study aided by a thorough acquaintance with the wants, and with even the minutest detail that could be made subservient.

All the fire alarm boxes in this city are connected by wires with the headquarters of the fire department, and are all numbered. When the hook in a box is turned down, the alarm is made only at the headquarters, where the operator, by the aid of a switch board, instantly sends the number of that particular box to every fire company in the city. In each company's house, near the door, are placed the gongs, recording apparatus, telephone, etc. (The position of the various instruments, the location of the engine and stalls, and of the poles by which the men descend from the upper floors, and the method of hanging the harness so that it may be placed upon the horses in less than a second, are all plainly shown in our view of the interior of the quarters of Engine Company 33, on Great Jones Street.) The first alarm is sounded upon a small gong, familiarly known as the joker, and the first stroke sets in motion a train of mechanical movements which, though in operation but an instant, produce most strange results, and change a scene of quiet into one of startling activity and of absorbing interest to the stranger who chances to be present. The first impulse of electricity passing over the wires attracts the armature of a magnet, which releases a small weight sliding on a rod placed beside the gong. This weight strikes the arm of a lever that permits the fall of a heavy weight located below the floor, and which is so connected as to withdraw the bolts holding the halters of the horses, who dash forward to their places under the harness. The same impulse of electricity has sounded the alarm upon gongs in the sleeping apartment on the second floor and in the reading rooms on the third floor, and the men come sliding down the brass rods. The time of receiving the alarm is recorded by a small clock that is stopped at the first stroke. Before the gong has ceased ringing the harness has been dropped and clasped, the driver is belted to his seat, and the men are waiting for the doors to be rolled back.

So far each company in the department has gone through these operations, since all are compelled to hook up at every alarm. The boiler of the engine is directly connected with a coil of pipe in an ordinary egg-shaped stove placed in the basement. Low down upon the rear of the engine are two pipes which are attached by telescope joints to two pipes leading up from the coil. When the engine is to go out, two valves which prevent the escape of water from the boiler are closed by moving a lever, and a rod pressed down through a hole in the floor. This rod operates four valves; two which close the pipes leading through the floor, and two which open pipes leading to a small tank in the ceiling, in order that the coil may be supplied with water during the absence of the engine. The rod also raises the lid of the stove to deaden the fire.

The strokes upon the joker might be compared to a series of dots and dashes sounded quickly—thus, two strokes and a pause, three strokes and a pause, and five strokes would indicate that the alarm came from box numbered 235. These strokes are repeated two or three times by the joker, and are then told off, but much more deliberately, upon the large gong. This arrangement is to save time, and while the men are hitching up they are counting the strokes, and if there is any doubt about the number they wait until the signal is given by the big gong. But it generally happens that the engine is on its way to the fire before the second gong has begun its work. After the exact number has been ascertained, all those companies which are expected to respond to that number start for the scene of the fire, while the other companies, after waiting a short time, unhook the horses and place the apparatus in the condition it was before the alarm was struck. We thus see that one stroke places the entire force of the department on the alert, and fifty-four engine companies (nine of which are double companies, and are provided with an extra engine and a large number of men), seventeen hook and ladder companies, and the two water towers are ready to turn out at every alarm. Many of the companies are frequently out of their houses in three, four, or five seconds, and at the last horse show in Madison Square Garden, this city, Engine Company 33 hitched up once in 1¾ seconds, once in 1⅝ seconds, and once in 1¾ seconds—or three consecutive times in less than 2 seconds.

The most important item in the time question is getting the horses in harness. The horses are placed in stalls as near the pole as practicable, and are kept bridled. The harness is attached to the engine, and is raised to such a height that the horse has no difficulty in passing to his place beneath it. It is suspended from a Y-shaped frame of tubing, at each end of which is pivoted a downwardly curved hook, upon which the harness rests. The reins pass through a catch in the center of the frame, so that by pulling them the hooks are released and the harness allowed to fall upon the backs of the horses. The collars are hinged at the middle, and one free end is provided with a bolt which enters a socket in the other end, in which it is held by a spring catch. The hinge is made wide so as to prevent lateral movement and insure the entrance of the bolt when the ends are brought together.

The forward fire engine shown in the illustration is from the Clapp & Jones works, and is what is known as second-class. The plunger is 4⅞ inches in diameter, and the engines (double) are 8 by 7 inches. The boiler is 64 inches high, 35 inches in diameter, has 120 drop water pipe tubes and 40 smoke flues. It is capable of throwing three streams, two side ones 2⅛ inches, and a center one 3¼ inches in diameter. It is not necessary to notify the engineer of the amount of water required, since the quantity can be controlled by the man in charge of the nozzle. In the nozzle is a conical shaped plug that can be moved longitudinally by turning a screw collar, and by this means a stream can be obtained varying from the size of a pin to the full capacity of the pipe. In case the nozzle is reduced or is completely shut off, the engine is relieved of all liability to serious strain by the action of an automatic relief valve designed by Mr. Pallett, of Engine 24. This valve is placed beside the pump, to which it is connected at two points, one above and the other below the plunger. The connecting passage is interrupted by a valve held upon its seat by a spring in such a way that the pressure necessary to raise the valve can be regulated at will. When the full power of the engine is required the valve is screwed down, but for ordinary work it is set at about eighty pounds. As soon as the water pressure in the pipes is increased beyond this point, by partially closing the nozzle, the valve is lifted and communication made between the top and bottom of the pump chamber; when the nozzle is completely closed, the valve is raised clear of the passage, and the pump churns the water round and round. The engineer is relieved of all care, and the control of the water is placed in charge of the one who best knows the quantity required. The spray nozzle consists of a cylinder, one portion of which is thickly studded with small holes, and upon which slides a collar wide enough to cover the perforated section when a spray is not desired.

The sleeping quarters of the officers and men are on the second floor. Through the floor, in locations so as to be most quickly used, are three openings, in the center of each of which is a smooth brass rod leading to the floor below. Upon the third floor are the billiard room, lockers, drying room, which has a zinc floor, and, together with the bathroom, is heated by a furnace in the basement, and feed room. Hay and grain are raised from the rear. The grain bins are connected with the lower floor by tubes, and the hay is passed down through chutes, so all the dust is confined to one small room.

When fighting a fire, it sometimes becomes essential to throw a powerful stream into the upper stories of a building, and to give the most satisfactory results the nozzle should be elevated and brought in close proximity to the window. This is accomplished by the water tower (shown in several positions in the upper view), which consists of a large pipe so mounted upon trunnions that it can be quickly raised to a vertical position. The lower end of this pipe is connected by a flexible pipe that extends under and to the rear of the truck, where it terminates in four 3 inch inlets, each of which may be coupled to a hose leading from an engine. Each inlet is furnished with a swinging valve, operated by the pressure of water in the pipe. Various lengths of pipe can be screwed upon the upper end of the trunnion pipe, giving the following lengths: single, 29 feet, long single, 36 feet, two short lengths, 43 feet, two long, 50 feet. Between the end of the pipe and the end of the nozzle is inserted a short piece of flexible pipe that moves between two side flanges. Projecting from each side of the nozzle is a stud that enters a groove in the flange. The nozzle is connected by a light wire rope with a small drum placed on the body of the truck, from which location all the movements of the tower are guided. By winding up this rope the nozzle will be depressed and will deliver water in a downward direction. The short connecting pipe bends upon a curved frame that prevents wrinkling. The elasticity of the pipe and the force of the water are sufficient to raise the pipe when the rope is unwound. To stay a long length of pipe there is a stout wire rope extending from the top to a drum at the base. This rope is extended by braces hinged to the lengths. The vertical pipe may be moved upon its own axis. The stream may be delivered at any height below a certain limit, and may be directed up or down or to either side.

A distributer to be attached to the end of a hose consists of two curved hollow arms, one at each side of the closed end of the pipe. Upon the hub of each of these is a pinion engaging with a gear on the pipe. When water under great pressure is sent through these arms, they are rapidly revolved upon their own axes and at the same time about a common axis, so that they send a shower of water in all directions.

Water tower No. 2 is located in the same house with Hook and Ladder Company 3, on Thirteenth Street. Few people have any conception of the number of implements forming the equipment of a hook and ladder company, and fewer people still have any understanding of the uses of these tools. The truck here referred to carries the following tools, the use of which we briefly mention: Two Bangor extension ladders, one 65, the other 45 feet long, so constructed that they may be made any length up to the extreme; two ladders 35 feet long, one 33 feet, one 25, one 20, one 15, one 12, one hook 20 feet long, one 15, one 12, two 10, and six 6 feet long. Two Babcock fire extinguishers, used upon small fires when required. One battering ram weighing 64½ pounds, and formed with a thick wooden section terminating in an iron shoe at one end and having a short rod at the other; this is manned by six men; its use is apparent. Six tubular hand lamps. Four rubber buckets. Seven forcible entrance tools. The iron shutters and doors upon the buildings of this city, being secured upon the inside, are most serious obstacles placed in the way of firemen, who, in order to effect a quick entrance, are supplied with crowbars and jimmies made of the best steel and after the most approved pattern. One 10-pound steel maul. Four cotton hooks, four hay forks, and two shovels for the removal of loose material. Four axes for cutting through floors, roofs, and partitions, and two picks for entering walls. One crow bar, ten wrenches and belts, including a gas pipe wrench for shutting off the gas when necessary; one roof rope 125 feet long; two horse blankets; one whip. One respirator, by which the wearer is enabled to enter dense smoke and to encounter noxious vapors. One distributer, described above. One four way connection. One length 3½-inch combination hose. One copper pipe 3¼ inches. Three nozzles. One iron pipe holder. One calcium light with oxygen and hydrogen tanks and fittings. This is found most useful in lighting up the scene of operations. Two danger flags, to signal trains upon the elevated railroads, one patent horse shoe, one butting stick, one brass gong, two cushions. One cellar pipe, 1⅜-inch nozzle, which is used to direct a stream to any part of a cellar, up or down, when thrust through a lower window, and which is of the utmost advantage in situations where the ordinary nozzle could only be made to deliver a downward stream. One cross bar and chain. Three scaling ladders of the following lengths and weights: 16 feet 35 pounds, 18 feet 39 pounds, and 14 feet 27 pounds. These are wooden poles backed with a strip of iron and having steps at about every fourteen inches. To the upper end is secured a right angled arm which is notched upon the under side and which ends in an angle piece. The hooks so formed are long enough to extend to the inner side of the widest window sills. The ladder is raised and the hook thrust through the window when the fireman ascends. Another ladder may be handed to him and by him hooked in the second window, and another in the third window, until a string of ladders reaches the roof, or he may support himself upon the sill, raise the ladder he came up by to the second window, and so on to the roof. One life line 150 feet long and three coils of life saving rope. The total weight of the tools is 2,718 pounds, and these together with the twelve men who go with the truck, and the truck itself, weigh 9,756 pounds.

Welding Fluxes.

We do not know that the following welding fluxes are any better than the welding material used generally by watch makers and silversmith, but they have been patented in England, so we publish them.

1. A welding material composed of 25 parts by weight of borax, a paper or metallic support, and 60 parts of metallic filings of the same nature as the metals to be welded, and made by first melting the borax; second, immersing the support in the fused borax; third, smoothing the same by passing it through pressure rollers; fourth, sprinkling its two faces with the metal filings; fifth, heating the sheet in an oven; sixth, passing through pressure rollers.

2. A welding material composed of borax and of metallic filings of the same nature as the metals to be welded, mixed with the fused borax, and in the proportions substantially as set forth, and then rolled out into sheets of about one sixteenth of an inch thick.

3. The welding sheets coated with a layer of gum lac or other appropriate varnish.

The following compound has been frequently offered as a trade secret: Take copperas, 2 oz.; saltpeter, 1 oz.; common salt, 6 oz.; black oxide of manganese, 1 oz.; prussiate of potash, 1 oz. Pulverize these ingredients and mix with them 3 lb. of nice welding sand.

A Lucky Inventor.

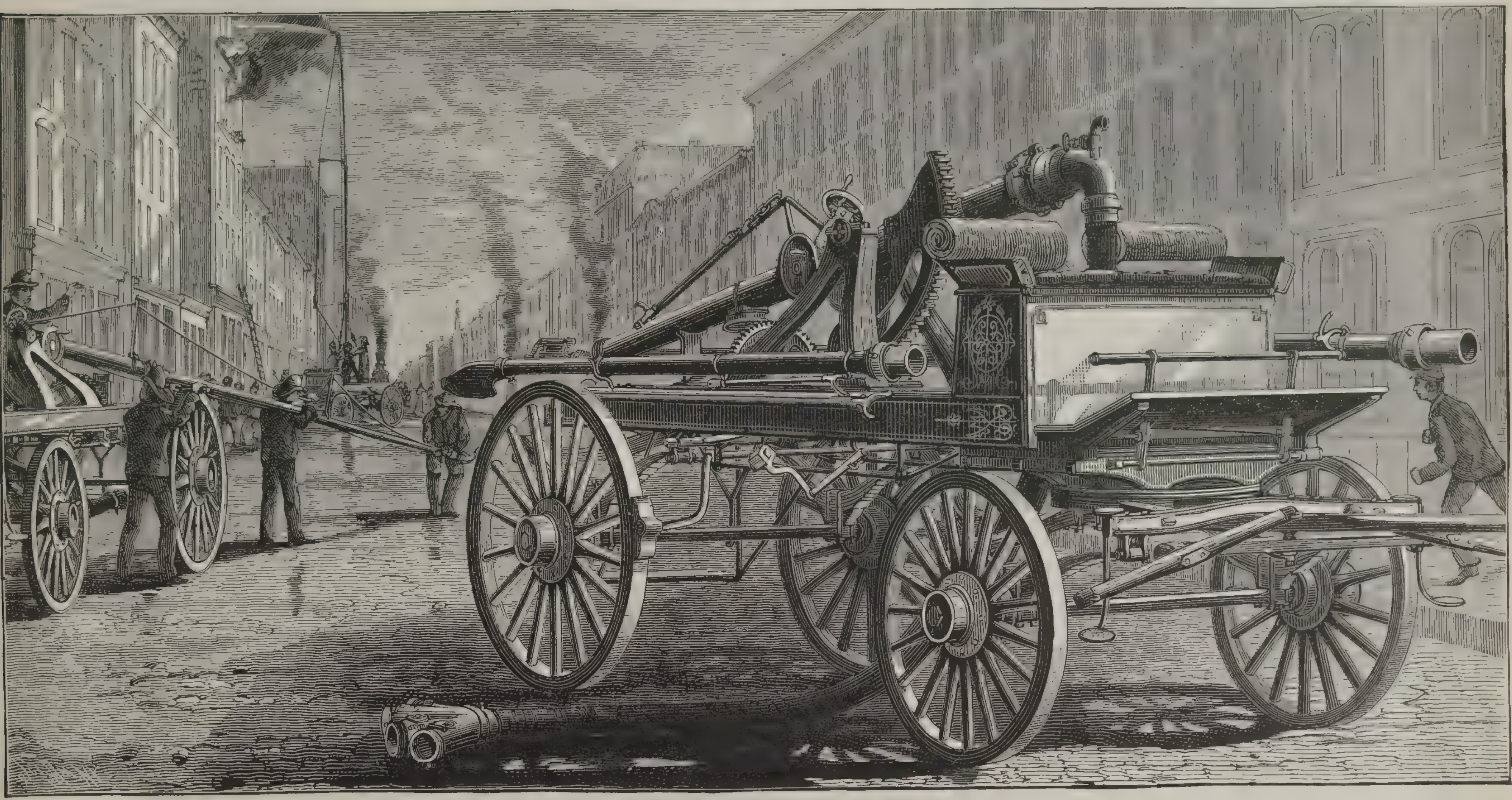
The *Milling World* says that George Westinghouse, before he invented and perfected his well known air brake, was regarded by a number of his then acquaintances with something approaching pity, because of his alleged lack of "gumption." His air brake was a success, and his friends began to think there was something in him after all. His automatic engine added to his fame and bank balance, and he mounted higher in the esteem of his former friends. A few weeks ago a valuable well of natural gas was struck on his premises at Homewood, near Pittsburg. The well is 1,580 feet deep, and the flow of gas is tremendous, the roar being almost deafening and scarcely endurable to the citizens of the neighborhood. Two other wells are being put down by Mr. Westinghouse, and he estimates that his profit therefrom will soon amount to $1,000 a day. We don't know what he wants of those wells, as he is not in straitened circumstances, but if some of those former friends, adds the *World*, don't just about bow down and worship him ere long, we'll miss our guess.

A Delicate Measure.

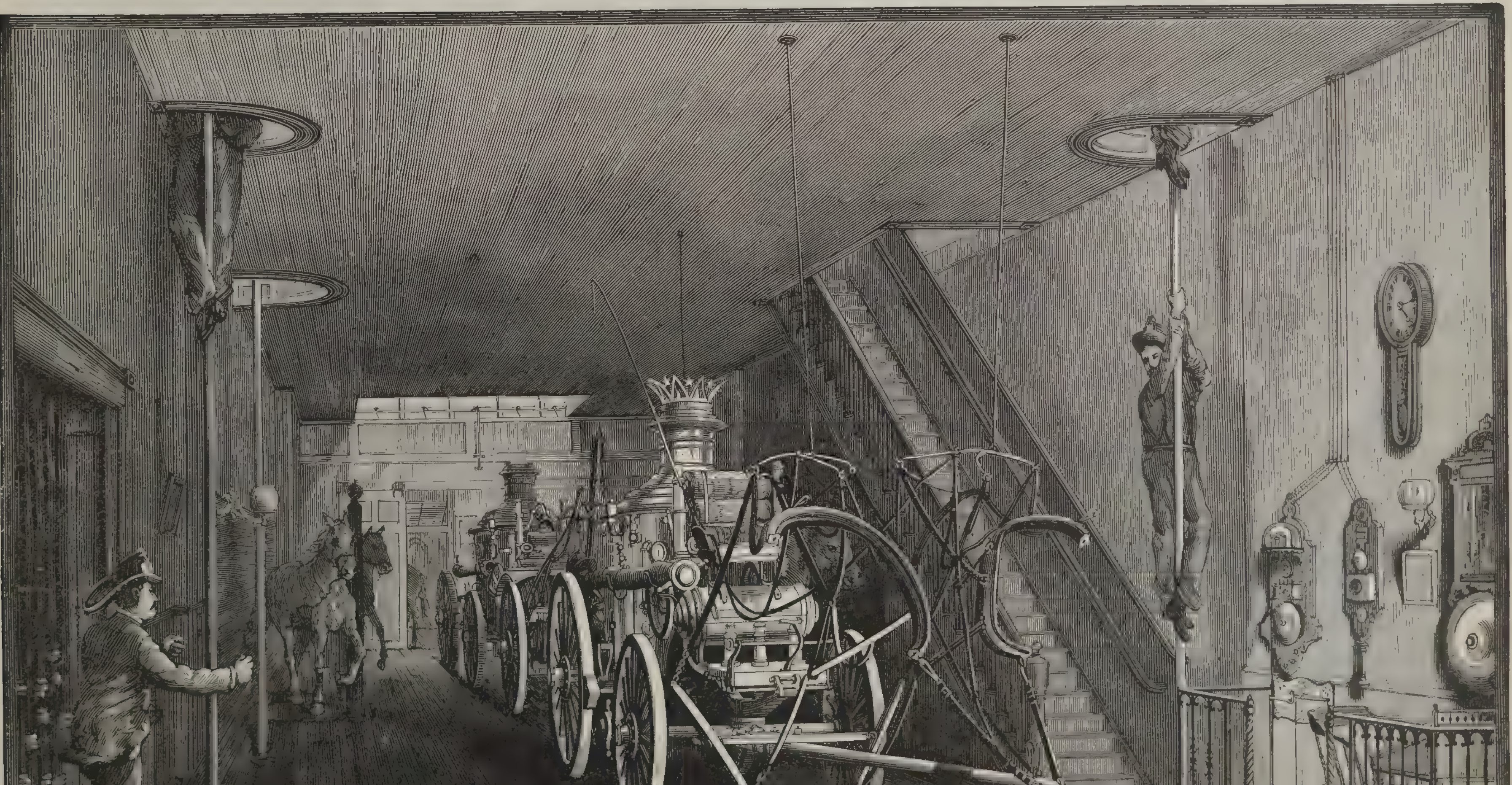
A curious little machine in the office of the Chief of the Stamp Bureau was the cause of the cancellation of a contract with an envelope firm that did not make their paper the thickness contracted for. It is a queer-looking contrivance, a cross between a set of butcher's scales and ordinary grocer's scales, or rather a combination of the two. There is a large dial, like the face of a clock, with a little hand that flies around the face, pointing to the figures at the side, which are arranged like the figures on the clock face, with little dots between. "You see three dots?" said the gentleman in charge, inquiringly. "Well, the space between those indicates one sixteen-thousandth of an inch. You see this movable piece of iron here, which comes down with a smooth surface upon this other solid surface? Well, the raising or lowering of that moves the pointer which runs around the dial. To test the thickness of a sheet of paper, we simply place it between this movable piece and the solid surface below; and when the movable piece of iron comes down upon the paper, the hand registers the true thickness of the paper. Delicate instrument?"

Then he took a hair, and slipped it deftly between the movable pieces. The hand on the dial followed the motions of the screw until it stopped at the figure 20. "Just twenty sixteen-thousandths of an inch in diameter," he said. "Now let me try a hair from your mustache. They are generally much larger, especially if you have been in the habit of shaving." He took up a pair of scissors, and clipped off a hair from the mustache and placed it in position. The hand stopped at 50. "Fifty sixteen-thousandths of an inch thick," he said. "That shows the effect of shaving. I measured a hair from the hand of a gentleman a few minutes ago which was forty sixteen-thousandths thick, but those in his mustache were precisely the same thickness, the reason being that he had never shaved."

Yes, that is the machine that proved that the firm making our envelopes was not fulfilling its contract," he said, as he fell back admiringly.



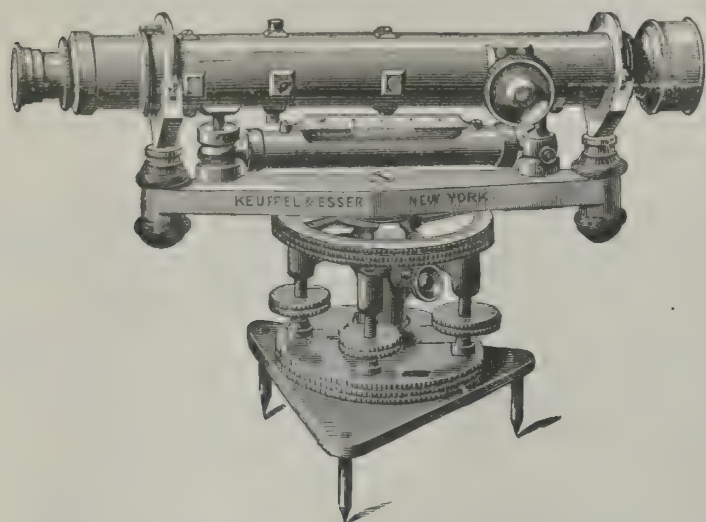
NEW YORK FIRE DEPARTMENT.—THE WATER TOWER.



NEW YORK FIRE DEPARTMENT.—INTERIOR VIEW OF A MODEL ENGINE HOUSE.

KEUFFEL & ESSER'S ARCHITECTS' AND BUILDERS' LEVEL.

The cut below represents a new article that will command the attention of everybody in the profession. The advantage of good tools of this description is too obvious to need explanation; and while this level



KEUFFEL & ESSER'S ARCHITECTS' AND BUILDERS' LEVEL.

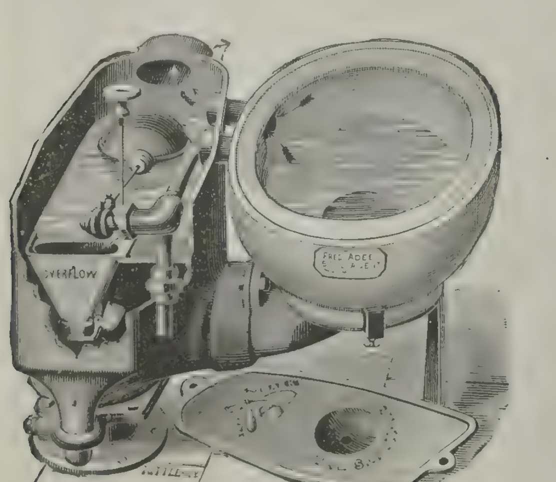
is certainly not as accurate as the finer, larger, and much more expensive instruments, it will do perfect work for the range required by architects and builders, and is certainly far superior to the several similar tools that have been offered in this market.

The achromatic erecting telescope is 11½ inches long, provided with sunshade, has an object glass 1⅛ inches in diameter, adjustable by rack movement, and has a magnifying power of about 24 times. The cross-hairs are of platinum wire. The bubble to the telescope is 5 inches long and graduated, the horizontal circle is 5 inches in diameter, and is divided to degrees, and has a vernier reading to five minutes. The instrument comes in a strong mahogany box, with the usual accessories, and costs, with the hardwood, brass-top tripod, only $45.00. It is manufactured and sold by Keuffel & Esser, 127 Fulton and 42 Ann Street, New York, who will be pleased to show the instrument to anybody interested. In connection with this level, Keuffel & Esser manufacture an accurately divided hardwood leveling rod of the New York pattern, with improved clamp and fine target, with vernier, engine divided to inches and eighths, 5 feet 6 inches long, and extending to 10 feet 4 inches. Although the price of this rod is only $6.00, it is in every respect first class, and will be found very serviceable in conjunction with the above level.

A circular describing the builders' level, or their catalogue of drawing materials and engineers' supplies, will be forwarded to any address.

THE SANITARY WATER CLOSET.

This closet—the construction and arrangement of which are very plainly shown in the annexed illustration—is so made that the reservoir, which is thoroughly ventilated, cannot contain any offensive matter, and, being of sufficient capacity to hold enough water to flush the soil pipe at each discharge, it keeps the soil pipes free and clean their entire length. The flushing takes place instantly, with a given quantity of



ZANE'S "THE SANITARY" WATER CLOSET.

water, when the pull is raised. The seal is positive. and insures the exclusion of foul air. Being supplied with water either from a tank at the top of the building or from the main pipe direct, it does not require any cistern and service box. It is extremely easy to set, the only necessary directions being to so set it that the reservoir will be level, and to adjust the float to give the desired quantity of water.

Messrs. Fred. Adee & Co., of 5' Cliff Street, New York city, can be addressed for further particulars.

Architects, Builders, and Others.

Where lumber is scarce or expensive, or difficult of transportation, owing to its bulk or weight, rubber roofing is a public benefit. Its compactness and light weight compared with lumber render it, where transportation is an item, the most economical roofing in the market. Skilled labor is not a necessity; and in ease of application and economy, rubber roofing leaves little to be desired. A heavy roof is not needed; for the greater number of buildings, it is to sustain no superstructure, nor be subject to extra weight at any time. A light roof answers every practical purpose, and does away with braces, girders, and numerous other contrivances necessary to sustain a heavy roof. These increase neither the comfort nor convenience of the building; *they do increase the cost.*

By using rubber roofing, a builder can quickly inclose a building, an important consideration at this season of the year. Rubber roofing is no new material; it has stood the severe test of time, being largely in use in all sections for the past 16 years. It is not only thoroughly water tight and a durable covering, but is fireproof. Its cost is only half the price of tin; and we would suggest that builders and all parties having a roof to cover or repair, write *at once* to the sole manufacturers, Indiana Paint and Roofing Co., 143 Duane St., New York city, or 42 So. Pa. St., Indianapolis, Ind. Samples and illustrated book circular free.

IMPROVED BELTING.

The "Electric" leather belting, now so universally and successfully used for dynamos, has many important improvements which make it very desirable for swift and steady running machinery. One of the best features of the belt is the quality of the leather from which it is made, namely, only the center or solid part of prime oak-tanned leather is used, and the leather receives a special coat of dressing; a composition which fills its pores completely and makes it more pliable, at the same time firm and less liable to stretch.

Another great advantage are those metallic wire screw

IMPROVED BELTING.

fastenings (see illustration). These screws are forced into the leather and cut off at both ends, leaving the surface of both sides of the belt perfectly smooth, and the belt can be run at pleasure on either side. All other modes of fastening need holes to be made into the leather, which naturally tends to weaken it, such as rivets, pegs, lace and wax-thread sewing, and make the belt stiff and clumsy, but these wire screw fastenings leave the belt as pliable as if nothing was in it.

Chas. A. Schieren & Co., of 47 Ferry Street, New York, are the manufacturers of the belt, and are receiving the most flattering testimonials from all parts of the country and from the most prominent scientific men.

THE JACKSON HEAT-SAVING AND VENTILATING GRATE.

We present herewith three views of this important improvement, now very extensively used where economy of fuel and pure air are desired in the apartments of dwelling houses.

The upper cut shows a front view of the grate. The next figure is a rear view; and the last figure is a rear view of the style used for heating rooms on an upper story.

Apart from the cheerful, exhilarating influence of the open fire on the household gathered about its hospitable hearth, it is well known that radiant heat direct from the surface of burning fuel possesses a comfort and health-maintaining power that no other form of heat can supply. For this reason the open grate has always been a favorite in our homes, and it is only because in the ordinary form it is such a great consumer of fuel, and so feeble in its heating capacity, that it has been supplanted by other more economical kinds of heating apparatus.

In the construction of the Jackson Ventilating Grate it will be seen that this defect has been avoided, and an economical method of heating has been secured, without the least impairment of the properties of the open fire-place. The Jackson Ventilating Grate has all the exposed fire surface of the common grate, thus being unsurpassed in the amount of its radiant heat, as it is unequaled by any in its amount of conserved heat.

Fig 2 shows the construction of the heat-saving chambers in the Jackson Fire-place, the outer shell being in part broken away. Pure air from outdoors is admitted through the opening shown in the base of the cut, and is distributed by the heated spurs there represented to the chambers directly back of and on the sides of the fire. From these chambers the now partially heated air enters the chamber shown at the top of the cut, through which the five smoke flues are seen to pass. These also imparting a large portion of their heat to the passing current, its temperature is

Fig. 1.

raised to 100° or 180° (according to the intensity of the fire), and it now passes a volume of pure air directly into the room through the openings in the frieze of the grate. In these chambers there are 15⅝ square feet of radiating surface. The chambers are separated from the fire by a cast iron shell that has no joints for leaking gas, the upper chamber, with its tubes, being cast solid, in one piece; and this shell, surrounded as it is by the air chambers, can never become intensely heated, and thus liable to burn out. The grate will accomplish as much heating as three ordinary grates, will thoroughly heat large rooms, and will ventilate perfectly.

Fig. 3 shows that form of the grate which is intended

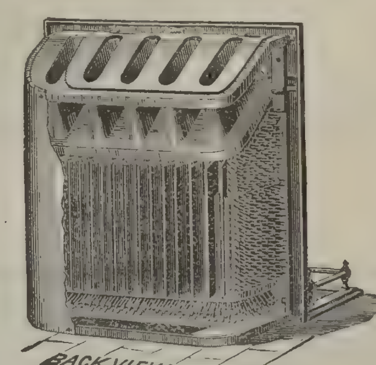


Fig. 2.

to heat rooms on different floors. By an inspection of the cut, it will be readily seen that the air, directly admitted from outdoors through the opening shown at the base of the cut, after becoming heated by circulating through the chambers, as described, passes through the valved opening at the top of the cut, and thence by a pipe to the room on the floor above that in which the grate is set. Closing the valve, wholly or in part, the conserved heat may be entirely or partially added to the heat of the room below.

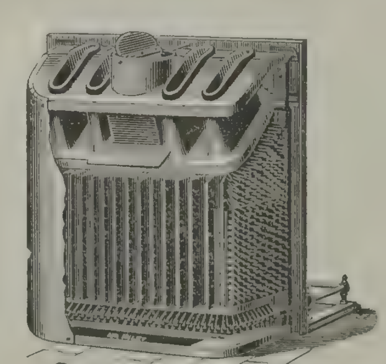


Fig. 3.

Edwin A. Jackson & Co., 77 Beekman Street, New York, are the manufacturers.

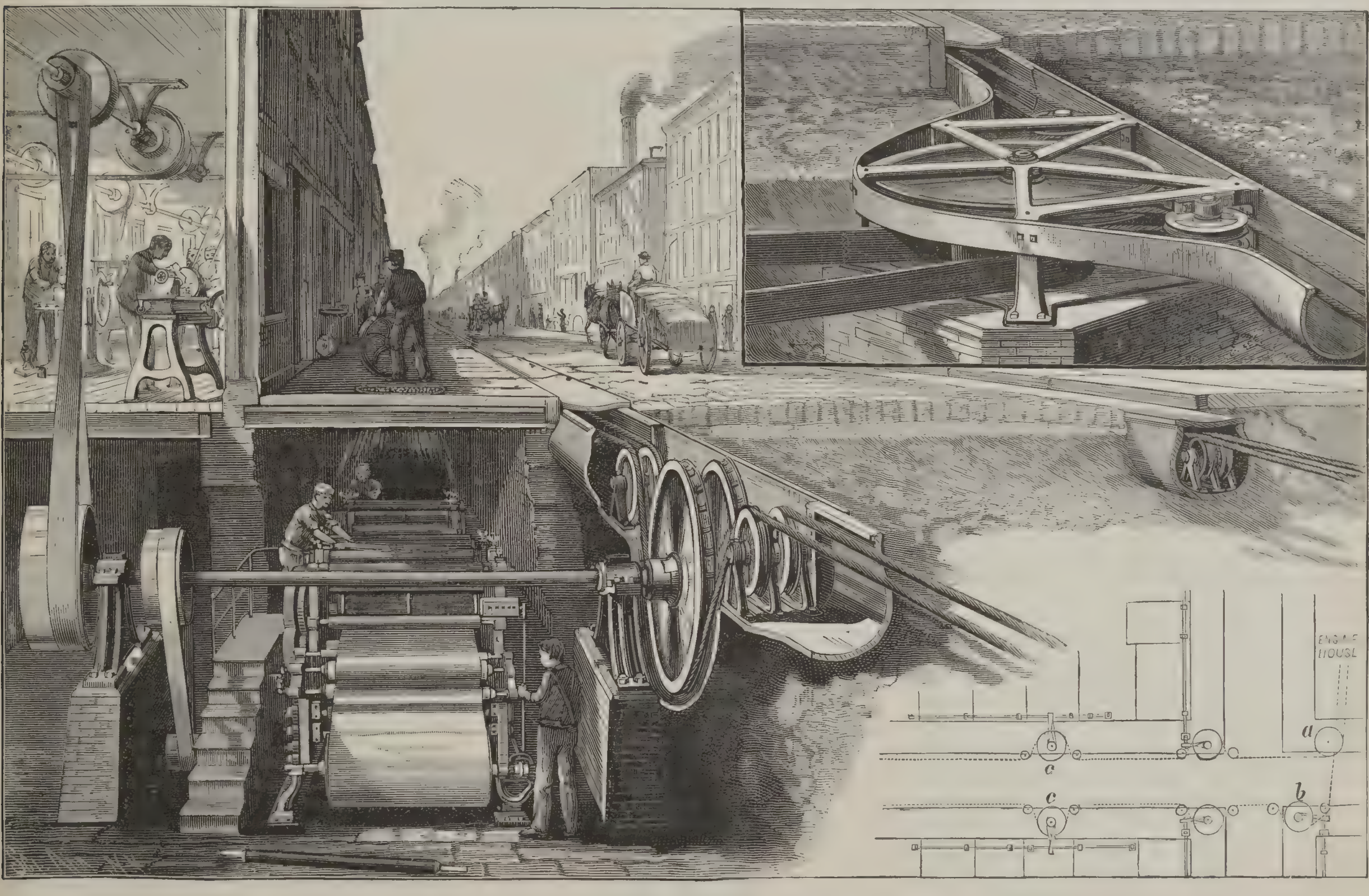
A Populous Section.

The district bounded by the Bowery on the west, Grand Street on the south, Avenue B on the east, and Thirteenth Street on the north, in the city of New York, is said to be the most populous square mile on the face of the globe, even outdoing Pekin, China, which, until lately, was supposed to be the most densely populated city in the world. The ground embraced in the above limits is said to measure one mile square, and it furnishes homes for two hundred and fifty thousand (250,000) persons, mostly Germans.

TRANSMITTING POWER FROM A CENTRAL STATION.

There has long been needed a system for the transmission of power from a central station to distant points which would be economical and reliable in operation and simple in construction, and which would overcome the obstacles attending the use of either steam, compressed air, water, or electricity. The advantages to be derived from such a system are too well known and appreciated to need discussion.

By using an endless wire rope, the entire power of the driving engine—less only the loss occasioned by the friction of the pulleys over which the rope travels—can be utilized. When the bearings of the pulleys are properly constructed, this loss is but trifling; and it is an important feature of this method that just as much power can be taken from the rope at one or two miles from the engine as can be taken from it directly at the station. The adoption of such a plan would result in the saving of the cost of engine and boiler and of the expense of their attendance, would permit the space occupied by such machinery to be utilized for other purposes, would abate the smoke nuisance arising from the many furnaces now clustered within a small area, and would enable those located along the line of the cable to obtain a power just sufficient for their work, whether it be the running of a single sewing machine or the driving of an entire factory.



BOONE'S METHOD OF TRANSMITTING POWER FROM A CENTRAL STATION.

The accompanying engravings represent a system recently patented by Mr. John L. Boone, of San Francisco, California, in which a wire rope is used to transmit power from a central station. The tube or tunnel in which the cable runs is laid below the surface of the ground, and is led in any required direction and its course changed as desired, but it finally leads back to the central station from whence it started. Inside of the tube, at proper distances apart—about twenty feet—are mounted vertical pulleys, except at the angles where the direction of the tube changes, when horizontal pulleys are substituted. A wire rope is then laid in the tube, so that it will be supported upon the vertical and passed around the horizontal pulleys, and its two ends united, making it endless. In the engine house or at some other suitable point on the line is constructed a take-up for the slack of the rope, which is thereby kept taut. The cable is driven by an engine, or other power, at a central station.

The tube may be of any desired shape, but it is preferable to make it cylindrical, and, since it can be placed in a less exposed and less traveled position than those used in the system for propelling cars, it need not be made of great strength. In cities it is proposed to construct the tube along the edge of the sidewalk, just outside of the curbstone, and to carry it around corners and deflect it where desired, so as to best accommodate the users of power. In this case the tube is made with an open top over which is placed a removable concave cover, which serves as a gutter to carry off surface water.

In order to take power from the cable and transfer it to stationary machinery, there is employed a grip pulley. At the point where the power is to be taken from the rope an opening is made in the tube, or a suitable chamber connected with the tube is constructed, so that the cable can be deflected and made to pass around one side of a grip pulley which is mounted on a shaft in the opening. Placed at each side of the opening are grooved pulleys of a suitable size, which are so mounted as to guide the rope to, and lead it away from, the grip pulley. This pulley can be placed either vertically or horizontally, as illustrated in the engraving. On the shaft is mounted a sliding clutch, on a feather, which can be moved against the side of the pulley, and either engage it by friction or by means of clutches. The speed can be easily regulated, as it is taken from the cable by means of differential pulleys, and the amount of power deflected at any point can be measured by a dynamometer. Any number of branch or supplemental endless cables can be located at various points and driven from the main cable. In order that no delay may be caused by the breaking of the cable, it is proposed to mount two ropes on two independent sets of pulleys in the same tube, thus keeping one rope always in reserve.

Among the many advantages which would accrue from the successful operation of this system in large cities are those having a direct bearing upon the safety and health of the community. In this city we have from five to six thousand boilers, which are just so many sources of danger to life and property, even when surrounded with every precaution and tended with the utmost care and skill. The permanent removal of these boilers would have a direct effect upon the atmosphere by relieving it of the noxious vapors arising from the combustion going on in their furnaces.

Another sanitary result would be obtained by doing away with the numerous steam engines, many of which exhaust into the sewers, the effect being to drive the hurtful gases up into the buildings.

The elevator shaft, with its accompanying engine, is now an essential part of almost every building erected in the business quarters of a city. By a system such as we have described these could be more cheaply built and operated than they can at present, and, by reason of an ample and constant power always at hand, their usefulness would be greatly increased.

The system has been examined and warmly commended by Silas Seymour, late State Engineer of this State; by Silas B. Dutcher, late Superintendent of Public Works of this State; by C. E. Candee, the inventor, and former superintendent of the Wabash Railroad, and others. Any further particulars which may be desired can be obtained by addressing M. H. Farley, Esq., the authorized agent of the inventor, at 165 Greenwich Street, New York city.

Is there a Snow Cap on Venus?

The planet Venus is now a morning star, and is a very brilliant object without the aid of the telescope. In the telescope it is a beautiful crescent. Its position is very favorable for telescopic observation. Taking advantage of this fact, our townsman, Isaac P. Guldenschuh, who has an excellent silver on glass reflecting telescope of seven inches aperture, reports an interesting discovery on the morning of the seventeenth of Aug., between three and four o'clock. Mr. Guldenschuh saw in profile on the convex edge of the crescent a brilliant white lenticular spot. This was cut out by a regular curve from the convexity of the crescent. The line of demarkation was sharply defined. He said he had seen nothing like it except the snow cap on Mars.

We suggested to him that in all probability he had seen a snow cap on Venus, although at the time we had seen no report of such an observation by any astronomer. This bright, lenticular spot cut into the broadest portion of the crescent, showing that, if it were a polar snow cap, the pole is now turned diagonally toward the sun. This was not very surprising, as the difficulties attending the determination of the axis of rotation are very great, and to this day the inclination of the axis of Venus to her orbit is not accurately known. It occurred to us that Mr. Guldenschuh may have hit upon a discovery of importance, and immediately consulted the authorities upon Venus. We found that the estimated inclination of the axis of rotation is not far from 75°, a fact which would fit the observation. Judging the present direction of the axis, from Mr. Guldenschuh's observation, and tracing the planet back to the time before inferior conjunction, it was seen that there must have been winter at the pole now visible before conjunction, and that summer is now approaching.

Upon consulting Webb's "Celestial Objects," we found in the appendix the following statement, which seemed to explain Mr. Guldenschuh's success: "Much attention has of late been paid to this planet, especially since the silvered reflector has been found peculiarly capable of defining it." In the same appendix it was learned that the bright spot had been seen by Browning on the 15th of March, 1868. It was on the circular limb, about 80 degrees from the south coast or horn. Browning described it as "so luminous as to show projection like the snow on Mars." This confirms the accuracy of Mr. Guldenschuh's independent observation. We are inclined to believe that both observers saw a polar snow cap. With the great inclination of the axis of Venus, one pole must be in darkness for six of Venus' months, and there is reason to believe that there is a great deposit of snow and ice during this period. If the inclination be 75 degrees, the tropics are but fifteen degrees from the pole. We trust that Venus will be carefully examined. Perchance the spot seen by Mr. Guldenschuh may be visible in the many refractors owned in this city.—*Rochester Democrat.*

ST. PAUL'S CATHEDRAL.

Our engraving is from *The Illustrated London News*, from which we also take the following:

From certain points of view, the beauty of St. Paul's Cathedral, irrespective of magnitude, excels that of St. Peter's at Rome, the Duomo at Florence, and every other building in this style. It is not best seen in front; we think the southeastern view, approaching from Cannon Street, is most engaging; but the most complete view of the whole structure is that presented in our engraving, from the southwest corner of St. Paul's churchyard. It was from this point, at a house where he lodged during the progress of his work, that Sir Christopher Wren used for a time to watch it growing up, as it steadily did from 1675 to 1710, within the great architect's lifetime. Its total cost was nearly £750,000, including the architect's salary of £200 a year.

Mr. William Longman's "History of the Three Cathedrals dedicated to St. Paul in London," published in 1873, relates the manner in which this "plan handsome and noble," as it was at once pronounced to be, was gradually completed, so far as concerns the exterior, leaving the internal decoration to a future age. The west front is not what it ought to have been; it was not by Sir Christopher's design, but at the command of the Popish Duke of York, that it was encumbered with two side chapels projecting on the north and on the south side, which lessen the apparent elevation of the towers; but the portico is grand, having two stories, the lower Corinthian, the upper Composite, like the rest of the building.

The two flanking towers have always been admired by architectural critics. The upper part of the sides is only a screen to hide the flying buttresses which have to withstand the thrust of the main vaulting, over the nave, choir, and transepts. It is well known also that the majestic external dome, with its diameter of 145 feet, surmounted by the stone lantern and lofty cross, is not the dome seen in an interior view. The inner dome, of brick, has a diameter of 108 feet; and the large space above, between this and the outer dome, is occupied by a conical superstructure which really supports the lantern and cross, while the outer dome, which is a shell of timber covered with lead, only seems to do so.

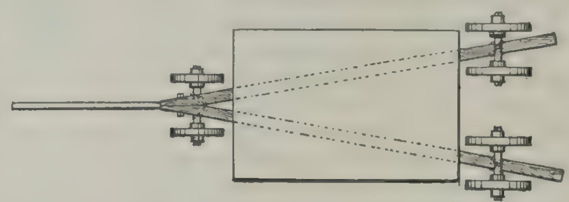
As a contrivance of engineering skill, this peculiar arrangement has great merit; but the purists of architectural sincerity may be inclined to regard it as a sham. The architect had intended, we learn from the "Parentalia," or memoirs written by his grandson, to make the dome of moderate height externally, corresponding with the interior; "but the old church having had, before, a very lofty spire of timber and lead, the world expected that the new work should not, in this respect, fall short of the old; though that was but a split, and this a mountain.

"He was, therefore, obliged to comply with the humor of the age, and to raise another structure over the first cupola; and this was a cone of brick, so built as to support a stone lantern of elegant figure, and ending in ornaments of copper gilt. As the whole church above the vaults is covered with a substantial oaken roof and lead—for no other covering is so durable in our climate—so he covered and hid out of sight the brick cone with another cupola of timber and lead, and between this and the cone are easy stairs to ascend to the lantern." It is, however, universally acknowledged that the exterior dome—surrounded at the base with a circular colonnade of thirty-two pillars, above which is a fine gallery, with an Attic order of pilasters—has unsurpassed grace and beauty of form.

A SIMPLE way to test the value of leather belting, and it is said to be a reliable one, is to place a cutting about three-tenths of an inch in thickness in strong vinegar. If it is of good quality, it will remain without alteration for a considerable time, simply becoming a little darker in color. But, on the contrary, if not well impregnated by the tannin, the fibers will quickly swell, and after a short period the leather becomes transformed into a gelatinous mass.

MOVING SMALL BUILDINGS.

In reply to an inquiry on this subject Mr. A. E. Sanford, of Belleville, N. J., says: We move buildings about here sometimes, and use for the purpose low wheeled trucks such as are used for boilers. Can move a small building by using ordinary strong wagons by placing them thus—



using one front part and two hind parts, letting the long timbers, which have to be strong, rest upon the bolster in front and tie them under the axle behind.

THURSTON'S AUTOGRAPHIC TORSION TESTING MACHINE.

This machine has for its purpose the determination of the torsional strength of materials, producing an autographic record of the values of elasticity, ductility, resilience, homogeneity, and ultimate resistance of the various metals, alloys, and woods used in engineering construction.

The machine is capable of revealing characteristic properties upon which to base sound practical judgment as to their relative usefulness for the various purposes for which materials of construction may be required, and also under the different conditions of their production or manufacture.

Simple in construction, and designed with special reference to rigidity and to convenience of operation, it provides improved methods of subjecting specimens to strains of torsion, either continuously or allowing periods of rest, the latter effect being to show remarkable powers of recuperation of strength in the specimen, when apparently giving way under continuous twisting strain; while all the effects of strain up to final rupture may be observed, the autographic record being presented by a curve traced by the machine itself.

By the use of this automatic recording device, the relation between the moment of torsion and the angle of torsion is represented graphically throughout the entire investigation.

Each pair of jaws receiving the specimen has its axis in the same plane, horizontally and vertically, and motion given to the worm wheel is imparted through the specimen to the weighted pendulum, which is hung on the opposite side of the frame, the bearing for which is carefully made to reduce friction as much as possible. A yoke, carrying a pencil, is attached or

THURSTON'S AUTOGRAPHIC TORSION TESTING MACHINE.

pivoted to the pendulum, and is guided at its upper end by a brass semicircular template, or "curve of sines," its inner edge being cut to represent a curve, the ordinates of which correspond to the torsional resistance of the weighted pendulum, while moving through an arc to which the corresponding abscissæ are proportional; while the rotation of the jaws attached to the worm wheel moves the pencil forward by the action of the guide curve upon the upper end of the pencil yoke, whenever the resistance of the specimen causes the pendulum to rise.

Upon the shaft connecting the worm wheel and the jaws which receive the end of the specimen is a brass drum, 5½ inches wide, and having a circumference equal to 36 inches. Upon this drum is stretched a specially ruled blank of section paper, each square representing one degree of arc. Upon this blank the strain diagram is autographically traced. The motion of the pencil in the direction of the axis measures the torsional moment, from which the tensile strength of the specimen may be deduced; while the rotation of the drum carrying the diagram represents the angle of torsion, from which is deduced the ductility of the material under investigation.

The ordinary maximum moment of stress, $\frac{5}{16}$ of an inch from the center, is 1,000 foot pounds. This may be increased 25 per cent. if desired.

By an improved device the worm can be readily disengaged from the worm wheel, and by carefully allowing the pendulum to swing back to its normal position, either by hand, or using the worm and wheel when engaged, the limit of elasticity may be readily determined.

A number of diagrams, representing strains or tests made of various metals or alloys, can be placed upon the same sheet, affording an easy comparison of results.

It is a testing machine that should find a place in the laboratory of every scientific school where the principles of resistance of materials are taught, and, if widely introduced into the iron working and steel making establishments of the country, would prove of invaluable assistance to the engineer in selecting the best materials of construction for every requirement.

This machine is now made by the Pratt & Whitney Co., Hartford, Conn.

STRENGTHENING THE ABUTMENT OF A GREAT BRIDGE.

Across the Schuylkill River at Chestnut Street, Philadelphia, is a two span bridge, begun in 1861 and completed five years later. It has two segmental arches supported by an abutment on either bank and a central pier in the river. At each side is a masonry approach. The spans are 185 feet each, and the total length of the bridge, including approaches, is 1,528½ feet. The carriage way is 26 feet wide, and the foot ways 8 feet. The western abutment is situated upon what was the river flat, there being, at the time of construction, 27 feet of mud, under which was a stratum of about 5 feet of gravel and bowlders, below which was bed rock. White oak piles were driven to a firm bed, and the heads of these, after leveling, were embedded in beton to a depth of 2½ feet; upon this foundation of piles and beton was laid a platform on which the masonry was erected.

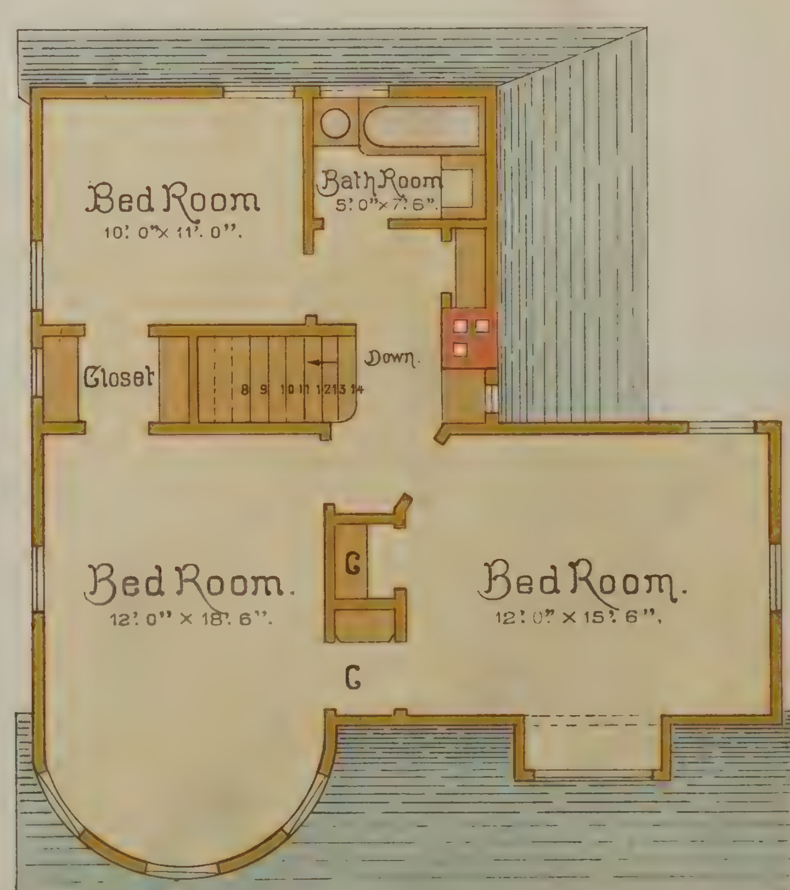
Since completion this foundation has maintained its vertical position, but the thrust from the long flat arch, exerting a pressure of some 2,000 tons, in a few years forced the western abutment through the yielding material in which it rested. A certain amount of this thrust was communicated to the approach through the two small arches, the effect of which was to compress the joints until, with the accompanying bulging of the masonry at points, the limit of movement was reached in the approach masonry, after which it continued in a rise of the two arches. It became evident that unless this movement was arrested the span would fall into the river. The fact that the space beneath the arches was used for traffic which could not be interrupted for any length of time led to the placing of wooden struts, at water line, from the abutment to the arch pier and from the pier to the base of approach, the effect of this being to transfer the thrust, through the struts, to the solid approach. This served the purpose so well that the wonder now is that the bases were not so constructed of solid masonry at first. The struts are shown in the large view in the accompanying engraving, and were each composed of four 12 by 12 inch timbers bolted and tied to one another. By this time the abutment had moved 8 inches and the central pier had moved half that distance.

The city now sought for something more permanent to save the bridge than timber struts. Several plans were received, but those proposed by Messrs. Anderson & Barr, of Room 12, Tribune Building, New York city, were adopted. The reasons governing this decision were that they were the only plans which would not interrupt travel on the railroad using one of the arches, thereby saving the city in damages about $40,000; the risk of lessening the stability of the abutment during the operation would be avoided, since the space made by the removal of material would be immediately refilled with the cylinder and concrete filling; and that by these plans the work would be so completed as to need no further attention in the future.

In brief, this plan was to build four iron cylinders of one-half inch iron, 8 feet in diameter, stepped into the base of the abutment and extended downward to bed rock at such an angle (about 45 degrees) as to embrace the line of thrust of the arch, and fill them with concrete. By this plan the weight of the arch is trans-

No 1.

FIRST FLOOR.



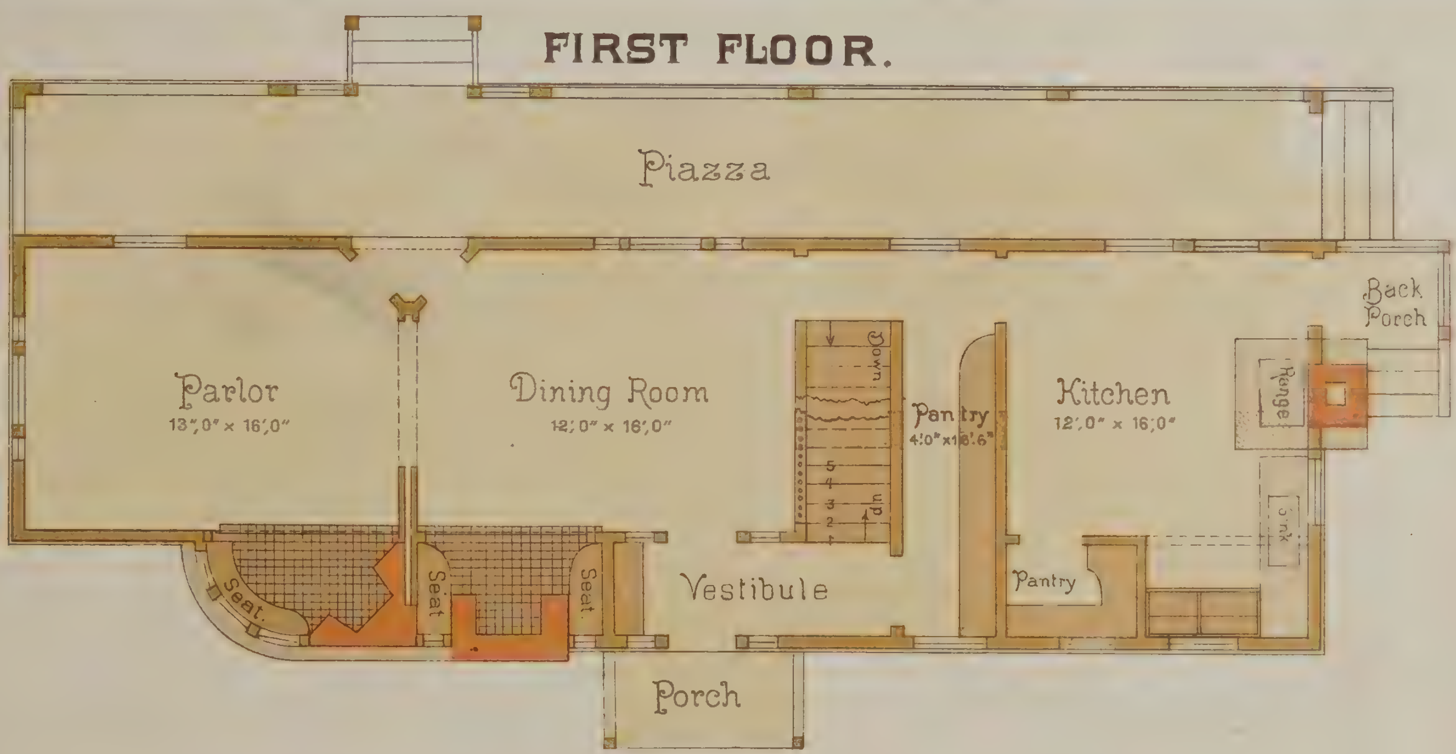
SECOND FLOOR.

Scale. 10. 5. 0. 10.

John. E. Baker, Arch't. 748 Broad St. Newark, N.J.

No 2.

FIRST FLOOR.



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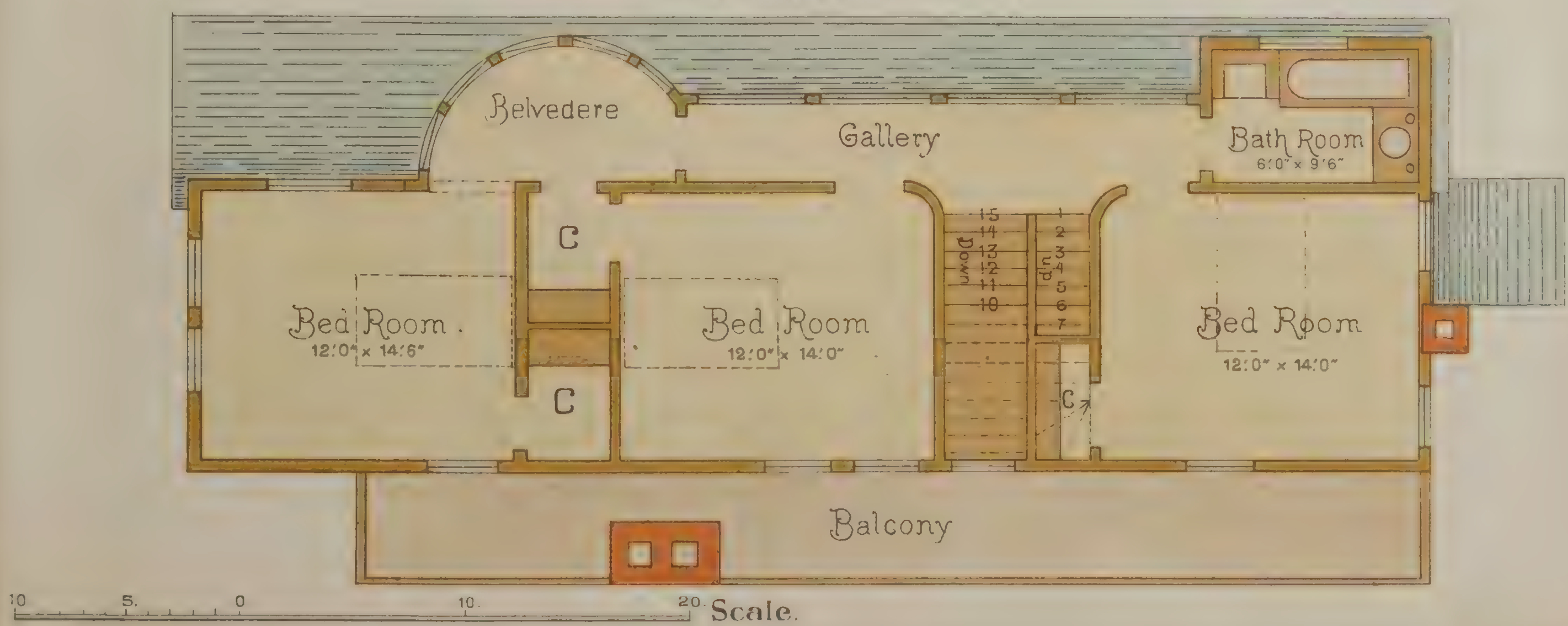


John. E. Baker, Arch't. 748 Broad St. Newark, N.J.

SCHUMACHER & ETTLINGER, N.Y.

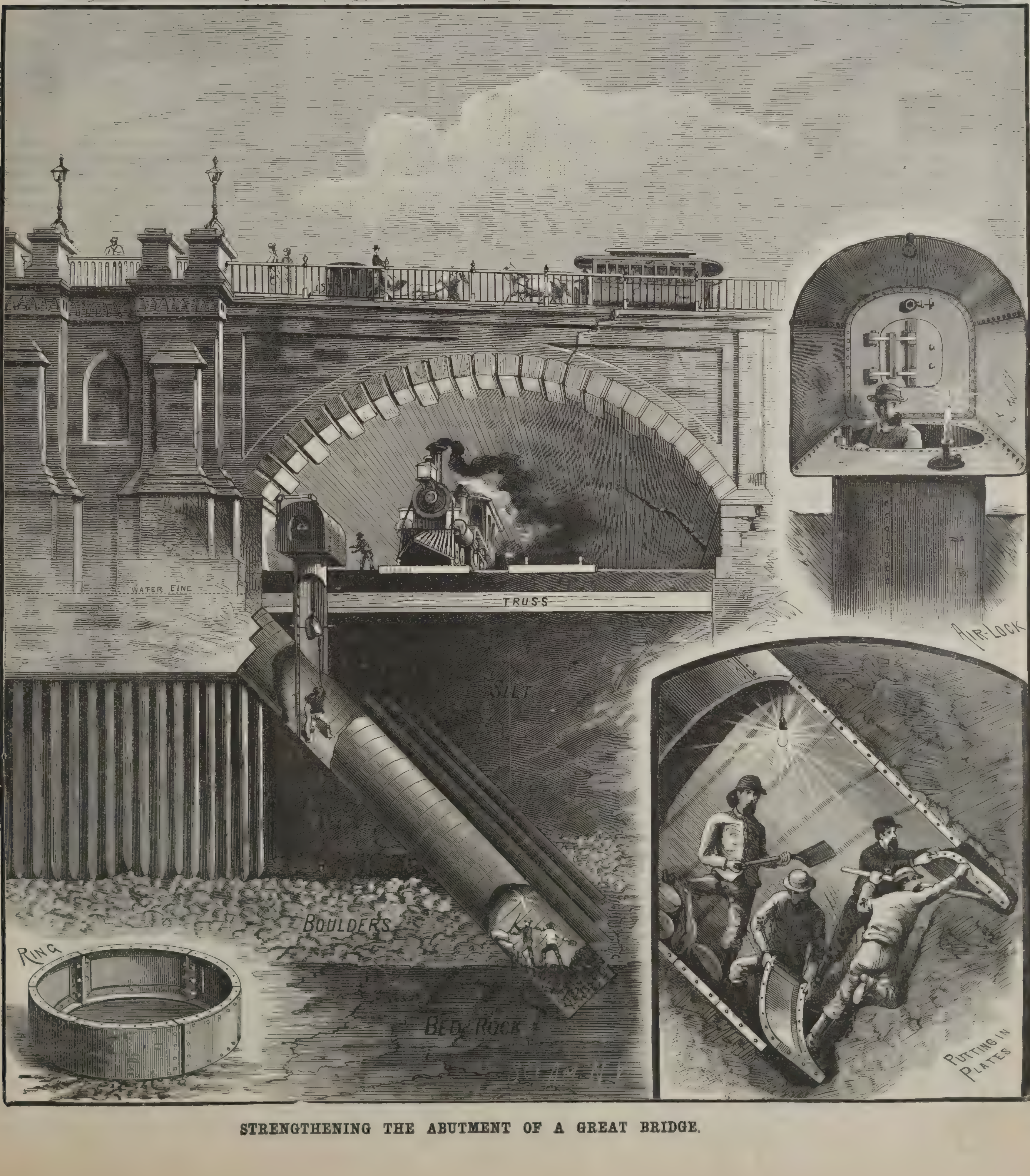
ferred to a solid foundation through four stone columns 8 feet in diameter. In carrying out this method no further disturbance of the ground was necessary than to start the cylinder. The concrete was made of 1 cement, 2 sharp sand, and 4 broken stone. Two of these stone struts have now been completed—one 65 feet long and the other 62 feet. Work was begun Oct. 21, 1884, and the first was finished Nov. 26 and the second Dec. 16.

The plan of projecting this class of work, below tide water, is by the aid of compressed air, similar in every respect to the plan so successfully used in the Hudson River Tunnel, and which we have frequently described and fully illustrated. At the upper end of the cylinder is a vertical stem 4 feet in diameter, across the top of which extends an air lock 5 feet in width and 14 feet long. This lock is divided into three compartments by four doors. The advantage of this construction is that while one compartment is being filled with material from the outside, the other is open to the interior; all waiting is done away with, and both the passage of supplies to the lower end of the cylinder and the removal of excavated material are greatly facilitated.

In building the cylinder, a space large enough to admit an iron plate is dug out, when the plate is inserted and bolted to those already in position; adjoining spaces are then excavated and other plates put in, and in this way the cylinder is formed—plate by plate, and ring by ring, until bed rock is reached. When complete, it is cleaned out and the concrete laid.

The plant for carrying on the work consists of a double air compresser—which may be quickly converted into a hoisting engine when necessary—a twenty-five light dynamo for illuminating the interior engines, etc. With regard to the cost of work of this nature, we are assured by the contractors that similar cylinders can be sunk to any depth up to 500 feet for less than one hundred dollars per foot.

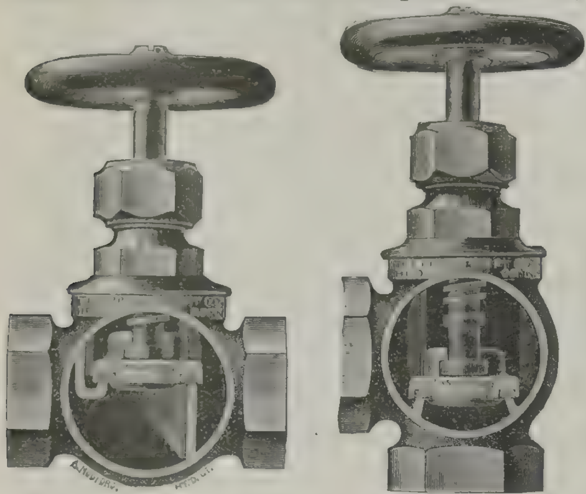
For engineering data connected with the bridge we are indebted to Chief Engineer S. L. Smedley and First Assistant Engineer J. M. Titlow, of the Philadelphia City Engineering Department.



STRENGTHENING THE ABUTMENT OF A GREAT BRIDGE.

THE VULCANIZED ASBESTOS RENEWABLE DISK VALVES.

Messrs. Fairbanks & Co., 311 Broadway, makers of the celebrated scales, are now supplying a very superior article in the line of Globe or Angle Valves, of which herewith we give illustrations. Some of the advantages claimed for these valves are: They are provided with vulcanized asbestos disks, composed of the fiber of asbestos, so wonderfully tough that the disks cannot be crushed or broken. The disk is also practically indestructible, being composed of a fireproof material, to which is added the waterproof vulcanizing material. The disk is held central on its seat by three guides cast on the body of the valve. It is also secured to the spindle without the use of nuts, screws, pins, wires, or anything that is liable to be detached while in use. The vulcanized asbestos ring is forced into the brass disk and then the metal is spun over the edges, so that there is no chance for it to split or peel.



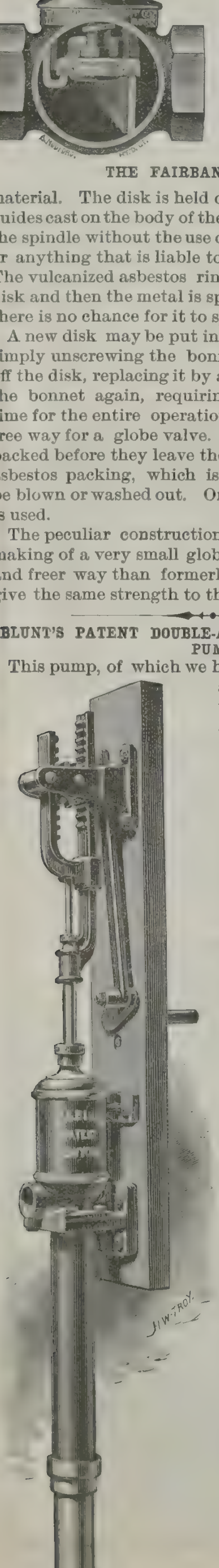
THE FAIRBANKS VALVES.

A new disk may be put into one of these valves, by simply unscrewing the bonnet of the valve, slipping off the disk, replacing it by a new one and screwing on the bonnet again, requiring only a few seconds of time for the entire operation. The valve has a very free way for a globe valve. The stuffing boxes are all packed before they leave the factory, with vulcanized asbestos packing, which is very durable and cannot be blown or washed out. Only first quality new metal is used.

The peculiar construction of this valve permits the making of a very small globe body with a more open and freer way than formerly, requiring less metal to give the same strength to the valve.

BLUNT'S PATENT DOUBLE-ACTING ARTESIAN WELL PUMP.

This pump, of which we herewith give illustrations, as furnished, is ready for use as a powerful suction and force pump, and is also designed to be used in wells 200 feet deep, or less, by extending the cylinder in the well and adding in between 4 inch pipe with the plunger rods in equal lengths. The two rods, one being one inch pipe and the other ⅝ inch steel rod, work one within the other and operate two plungers, which also work one within the other, the lesser one descending as the larger one rises, each drawing and forcing alternately. Each plunger has a full stroke of eight inches. Diameter of inner plunger, 3¼ inches; area, 8·2958 square inches; diameter of long plunger, 3¾ inches; area, 11·0447 square inches; total, 19·3405 square inches. 2 inch suction, 2 inch discharge pipe. One full revolution or double stroke gives $\frac{67}{100}$ gallons. A speed of 40 strokes gives 26 gallons per minute. The advantages are as follows: The *rods balance* each other, leaving only the weight of water to be lifted. The water has a continuous and direct upward movement through the interior of the 4 inch pipe, a consequent great saving in friction and of power in overcoming inertia of column of water. The two plungers can be pulled up through the pipe for repairs without disturbing the cylinder. These pumps rank among the best for all kinds of work. Double-acting pumps with heavy service cylinders are provided for the deepest wells. W. S. Blunt, maker, 100 Beekman St., New York.



Curative Power of Water.

There is no remedy of such general application and none so easily obtainable as water, and yet nine persons in ten will pass it by in an emergency to seek for something of less efficacy. There are but few cases of illness where water should not occupy the highest place as a remedial agent.

A strip of flannel or a napkin folded lengthwise and run out of hot water and applied around the neck of a child that has the croup will usually bring relief in ten minutes. A towel folded several times and quickly run out of hot water and applied over the seat of pain in toothache or neuralgia will generally afford prompt relief. This treatment in colic works like magic.

We have known cases, says the Boston *Journal of Commerce*, that have resisted treatment for hours yield to this in ten minutes. There is nothing that will so promptly cut short a congestion of the lungs, sore throat, or rheumatism as hot water when applied promptly and thoroughly. Pieces of cotton batting dipped in hot water and kept applied to all sores and new cuts, bruises, and sprains is the treatment now generally adopted in hospitals.

A sprained ankle has been cured in an hour by showering it with hot water poured from a height of three feet. Tepid water acts as promptly as an emetic, and hot water taken freely half an hour before bedtime is the best of cathartics in cases of constipation, while it has a most soothing effect on the stomach and bowels.

HOT WATER HEATING FOR SMALL DWELLINGS.

In this advanced age, when no expense or pains are spared in regard to the interior decorations of modern dwelling houses, and where comfort is the all important point sought after, our attention has been called to the subject of heating.

In the days of our forefathers, the large open fireplace, with its glowing back log, was the only method known to them for warming their dwellings; and although the same has furnished the subject for many a verse and song, yet when the matter is thoroughly investigated by research, we learn that during the long, cold winters of that time the question of keeping warm was a stern reality with them. There was plenty of heat in the roaring fire, but instead of radiating throughout the apartment, it was carried up and out through the spacious chimney.

Later, in our grandfathers' day, the box wood-stove superseded the open fireplace; and after the discovery of coal in this country, they in turn were superseded by the base burner and the modern hot air furnaces.

Although steam heat for large public buildings has been in use, yet it is only recently that it has been used for small dwellings. When this was practically demonstrated, we were under the impression and belief that the acme of house heating had been reached; but such was not the case, for the ever restless mind of the heating engineer has at last demonstrated that for healthfulness and comfort, the system of heating by hot water stands to-day at the head for warming dwellings. The day is not far distant when the old-fashioned hot air furnace—the source of many headaches—is doomed to die; and we who are fortunate enough to have our residences warmed with the genial heat that proceeds from the hot water system say, "So mote it be."

With the hot water system, the dwelling can be kept thoroughly warmed every hour in the twenty-four, if desired, by giving the apparatus attention but once in twelve hours; while with the most improved hot air furnaces, in the extreme cold weather, we only expect to warm the living rooms, and that not until midday, with the consumption of coal out of all proportion to the amount of heat distributed.

For the information of those who have never looked into the subject, we wish to note a few of the advantages of hot water heating. First, hot water radiators will heat with a low fire, and will continue to give out heat as long as a spark is left in the generator. Should the fire be neglected and the temperature of the water in the generator fall, still the apparatus is doing its work; while with the hot air furnace, unless strict attention is paid to it, fire may be burning and the fuel wasting, with very little results as to heat thrown out; and we would further remark that there is no danger from fire or explosion, as the generator is open to the air through the expansion tank.

There are a great many people who think they cannot afford to put in hot water apparatus for warming; they say it costs too much. This only shows that they have not made a careful estimate, for an ordinary small dwelling can be heated at an expense of from $300 to

Fig. 1.

$400, and in less than ten years' time the saving in fuel, repairs, and attention required would amount to 100 per cent in favor of the hot water system, to say nothing about the great gain in comfort and healthfulness, which is beyond computation; for hot water is considered the most healthful heating at present known for dwelling houses, and it is an established fact that in houses where hot air furnaces are used, house plants would not thrive; but after hot water was introduced, the same variety of plants had been grown successfully. Quoting from an article by J. Drysdale, M.D., and J. W. Hayward, M.D., of England, published in "The Health and Comfort in House Building," they say: "As a proof of the healthfulness of hot water heat, we may notice that one of us, who has lived for years in a house heated by the hot water system, is a general practitioner of medicine, which involves being frequently called out at all hours of the day and night, yet no increased liability to cold or delicacy of any kind has been observed; on the contrary, whereas previously, when living in ordinary houses heated with hot air, he frequently suffered from bronchitis, quinsy, and headache, he has never suffered from either of these complaints since living in his present house; and a member of his family, who had previously to spend several winters in a warm climate, is now able to remain at home and

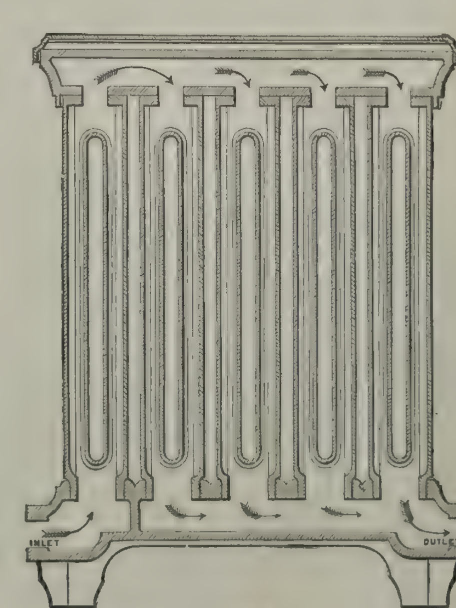


Fig. 2.

go about in the open air all the year round. For prevention of disease, we hold such a house to be a most important auxiliary."

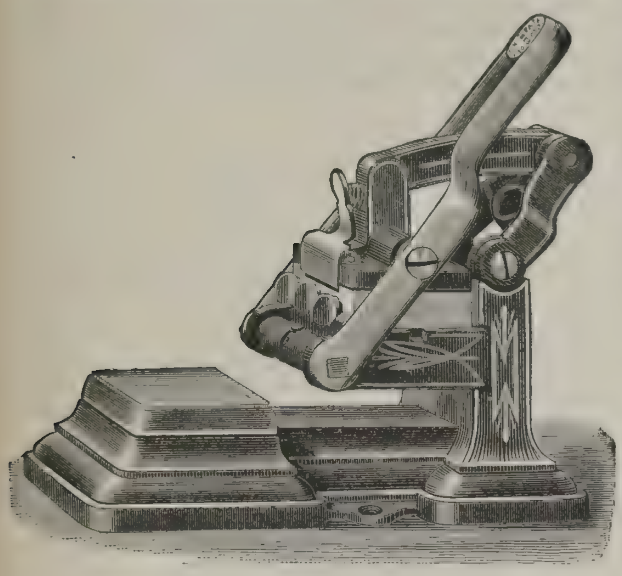
One of the best hot water radiators on the market is the Bundy, constructed from the well known steam radiator manufactured by A. A. Griffing Iron Co., 900 Communipaw Avenue, Jersey City, N. J., who are glad at all times to answer any inquiries made to them relative to the subject.

Fig. 1 represents front view and Fig. 2 a cross section of same.

Any one familiar with the construction of radiators will see at a glance its peculiar construction and merits.

IMPROVED COUNTING-HOUSE STAMP.

We herewith illustrate a printing stamp of novel construction, which possesses many important advantages, the chief of which is that its printing is of superior quality. It does not require to be replenished with ink oftener than once in six months or a year. It is noiseless and almost frictionless in action, and instantly adjusts itself to a change from one die to another, either with or without changeable dates, and is especially fitted to use the well-known interchangeable metal-bodied rubber type, by means of which any required printing die may be quickly set up on the spot for immediate use. The ink fountain is so



IMPROVED COUNTING-HOUSE STAMP.

formed that by properly charging it the stamp is capable, it is stated, of giving fully 200,000 fine impressions, while the ordinary ribbon dating stamp will give from an inking ribbon of best quality not over 10,000 impressions, and to obtain those the ribbon must be moved along to a fresh spot fully 200 times, each of which moves requires as much time as to reverse the inking cushion in the new stamp, which need be done not oftener than once for each 10,000 to 20,000 impressions. To print with this stamp, instead of striking a blow or pushing down a plunger, a lever is pulled forward by thumb and finger, moving the printing die, which is guided by a parallel motion, from the inking cushion to the impression bed, and, upon releasing, is instantly returned to place by a spring, restoring the printing face of the die to contact with the inking cushion.

The engraving shows the stamp as adapted to general use; another style is made, especially adapted to the use of banks and bankers. It is the invention of Mr. R. Hale Smith, and is manufactured by the R. H. Smith Mfg. Co., 295 Main Street, Springfield, Mass., who may be addressed for further information.

PORTABLE BATHING AND TOILET CABINET.

The construction of this cabinet is so fully shown in the accompanying cuts as to render a lengthy description unnecessary.

The top contains a tank or reservoir lined with copper, holding about 75 gallons of water, and may be supplied either by running water or a force pump from well or cistern. The base contains a bath tub, over which is a marble-topped wash bowl, mounted on rolls and track, so as to move easily from one position to another. In the end of base is a swinging commode or water closet, supplied with water from the tank, and trapped with a complete cut off from the sewer or soil pipe, so as to give back no odor or gas. Inside the cabinet, at one end, is a boiler of nickel-plated copper, holding eighteen gallons, and constructed so as to give 342 square inches of heating surface. This is accomplished by a coil of seven-eighths copper pipe, eleven feet in length, receiving the water from the center of the boiler and passing in coil over the flame, filling the whole bottom, then passing through the boiler and delivering the water at the top, producing a circulation which gives a supply of hot water much quicker than by any other means, and is drawn by a faucet to the bath tub or wash bowl, while the cold water is drawn direct from the tank.

Below the boiler is a kerosene oil stove, made of heavy copper, and nickel-plated. It has four burners, five inches wide, so constructed as to give off no smoke or odor. A gas stove can be supplied when desired.

Among the many advantages which it possesses are the following:

It may be placed in any room where it is not in the way and does not interfere with the use of the apartment for other purposes.

Hot and cold water may be had any time, day or night, independent of the range boiler.

It will heat water quicker than by the range.

It can be removed from house to house the same as furniture.

All plumbing necessary is to make one connection to bring the water to the top or reservoir and one to carry it out.

The cost is less than the fitting up a special room, which could not be used for any other purpose than a bath room.

It saves the cost of making separate cabinets for the bath tub, wash bowl, and water closet, together with the independent plumbing connections.

It saves all circulating pipes, which are liable to freeze, except when the house is heated by steam or hot air, as is necessary with set tubs.

These elegantly finished cabinets are worth, after removing all the inside parts, more than half their entire original cost for a wardrobe alone.

They furnish all the means for a bath of whatever character, hot air or dry, vapor, shower, hot, and cold water and sitz bath, at any hour day or night, without leaving the room or requiring the use of the range.

Additional information may be obtained by addressing Mr. W. V. Collender, the exclusive manufacturer, at the factory and general office, Stamford, Conn., or these cabinets can be seen at the office of the Brunswick, Balke & Collender Co., Union Square, New York city.

ORNAMENTAL IRON AND ZINC WORK, ETC.

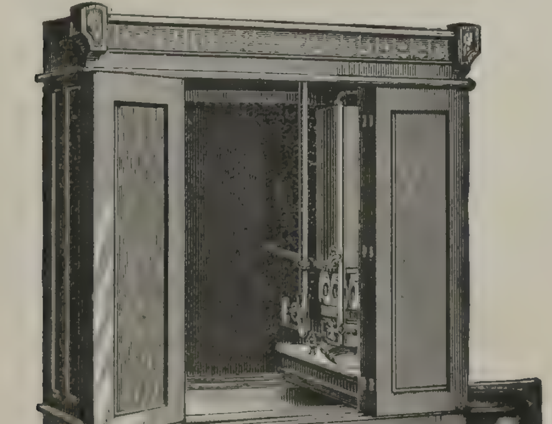
The facility with which important additions can be made to the appearance of a house and grounds, by the development of one or more details of an ornamental character, has encouraged the growth of a considerable industry in the making of certain forms of iron, brass, and bronze work, which is of great durability, and ornamental as well as useful. Of goods of this character Mr. J. W. Fiske, of New York city, is one of the largest manufacturers, and his several illustrated catalogues show a variety of artistic work in this line which renders it no easy task for one to select what is best, where so much that is highly excellent is offered. From his catalogue of copper weather vanes and finials we copy the illustration of a new design for a vane which is gilded with gold leaf, but this is only one of a great number of designs shown, adapted for a wide variety of tastes. In iron crestings, bannerets, finials, and crestings, the designs are numerous enough to fill another illustrated pamphlet, and show much of the best work seen in our latest buildings, both public and private. Ornamental lamp posts and lamps form another department of Mr. Fiske's work, in which new designs are constantly being presented. Perhaps one of the most notable of these is the handsome electric clock post recently designed and put up by this establishment, at the corner of Wall and Broad Streets, in front of the Mackay-Bennett Cable Company's offices, being in form an immense globe, and at once signifying

ORNAMENTAL WEATHER VANE.

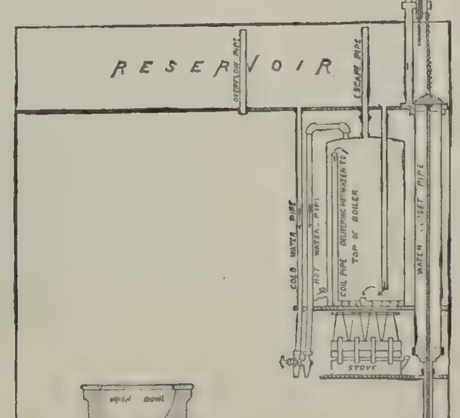
a worldwide system of telegraphy. The making of iron, brass, and bronze stable fixtures, with every description of interior and exterior fittings, has long been a specialty with this house, and their work is now to be seen in the stables of all the leading express companies and horse car railway companies of the country, as well as in the best appointed private stables. In this connection it may be mentioned that the house has a patent self-feeding manger, to prevent the horse from eating too rapidly. Besides what has been mentioned above, other catalogues give a great variety of designs for fountains, vases, statuary, figures of animals, etc, all well worth the examination of intending purchasers in this line.

An Interesting Shakespearean Relic.

Any person desirous of inspecting the actual last will and testament of Shakespeare can do so by visiting Somerset House, London, and paying a shilling. The visitor is conducted to a dimly lighted room, in which it is preserved, and is not a little astonished to find it securely fixed in a series of frames protected by glass. The will remained for many years without any attempt being made to protect it from the wear to which it was subjected. Indeed, the reference to the will during the period at which it was unprotected has slightly worn away the writing at the folds of the paper. It is a remarkable fact that for every Englishman who visits Somerset House to inspect it there are at least two Americans.



Cabinet with Wash Bowl under Boiler and Commode swung out from end.



Sectional View of Cabinet.

Cabinet with Mirrors on Inside of Doors and Wash Bowl in Position for Use.

COLLENDER'S NEW PORTABLE BATHING AND TOILET CABINET.

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors,

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

NEW YORK, MARCH, 1886.

THE

Scientific American,

ARCHITECTS AND BUILDERS EDITION.

This is a Special Trade Edition of THE SCIENTIFIC AMERICAN, issued Monthly—on the first Saturday of the month.

It goes directly *into the hands of those who have the ordering of the great bulk of Building Materials and Appliances*, namely, the Architects, Builders, Constructing Engineers, and Contractors.

It has the largest circulation of any Architectural or Building paper in the world.

An Increase of Trade will necessarily accrue to all Manufacturers and Dealers whose establishments are conspicuously represented in this important edition of THE SCIENTIFIC AMERICAN.

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CONTENTS

Of the March number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

DESIGNS FOR TWO SMALL COTTAGES.*

NO. 1 AND NO. 2 TO COST $2,500.00 AND $3,000.00.

[Two colored plates with detail sheet.]

BY JOHN E. BAKER, ARCHITECT, 748 BROAD ST., NEWARK, N. J.

General Observations.—The small cottage is generally made to resemble the mansion, on a smaller scale. The hall, parlor, library, kitchen, and bedrooms, etc., are all squeezed in, and the occupants will be squeezed in, and so the squeezing process continues, until their patience is worn out, and they determine to find a house with only two rooms on each floor, where they can have room to "swing a cat." Have you ever stood in one of these houses, and watched a noble knight buckling on his armor for the day's battle? He puts both hands in the sleeves of his "coat of male" and suddenly throws them out; the right hand darts through mirror on the hat rack, the left hand goes through an ancient print on the opposite side—a picture perhaps of his mother-in-law—which has adorned the wall for years and years and has done much to give warmth to the hall, to "welcome the coming and speed the parting guest." Look at plan No. 2. The entrance is directly into a large square room, with a cheerful open fire place, a screen through which the stairs appear, the opening at the left. Through a half-drawn curtain we pass to the kitchen or ascend to the second floor. The stairs can be curtained off from the living room, if so desired. The stairs are convenient to the kitchen, therefore avoiding a private stairs; if the family are dining, we take the visitor into the parlor, and seat him in the cozy nook which contains an open fire-place with seats on either side—a fire-place built not for looks, but for actual use. This nook obtains light through a quaint stained glass window, which makes it a desirable place for reading. The second floor contains three bed-rooms and bath-room. The hall is central, and is lighted through a window at side of chimney. One or two rooms could be furnished in attic.

A vestibule can be built on the piazza large enough to accommodate two or three persons, which would make the dining-room more private for some parties. The foundation of this design is carried up to the window-sills of stone. This cottage can be built for $2,500.00.

Design No. 2 is for a cottage, with an entrance hall. The view shown in colored plate is the road front. The garden front, which in this case has the more pleasant outlook, has a large piazza extending across the entire front of building. The large recessed fire-places in the dining-room and parlor with the easy high back seats, as shown in plan and drawn to a larger scale on the detail sheet, will explain themselves. The second floor contains three bed-rooms, third floor contains three bed rooms. The chimneys and foundations of rough stone, as shown. An entrance is obtained from the piazza to the parlor and dining-room. Cost of this cottage, $3,000 00.

SPECIFICATIONS.

Excavating.—Do all excavating necessary for cellar, trenches, piers, privy vault, cesspool, etc. Earth graded about building. Cart away mason's rubbish. Excavated material graded around the premises. Outside of foundations cemented.

Foundations.—Start walls 6 in. below cellar bottom, and carry up same 18 in. thick, with good quarry stone, laid in cement and sand mortar, plastered outside one coat cement mortar. Build area wall up to grade, same thickness. Put down foundations under piers, 2½ ft. deep of concrete.

Brick Work.—Build up chimneys with fire-places and flues as shown, joints in flues and kitchen fire-places struck. Turn arch over kitchen fire-place, and trimmer arches to all fire-places. Put in three earthenware stovepipe collars with tin covers. All brick work to be laid up with hard Jersey brick in cement and sand mortar. Partition walls in cellar of brick 8 in. thick.

Drains.—Lay 4 in. vitrified earthen drains from house to cesspool, situated 30 ft. from rear of building, also from leaders to gutter, all joints thoroughly cemented, to be laid 2 ft. below grade. All pipes to be submitted to architect before being covered. Also lay 6 in. drain from leaders to cistern, as shown on plans.

Bluestone.—Cellar window sills 3 in. thick, cesspool flag 2 ft. × 2 ft., chimney caps 2½ in. thick, kitchen hearth 1·6×4·0. The above to be of sound blue quarry-dressed stone. Area steps 10 in. wide, set with brick risers. Coping on area walls bedded in cement. Cellar piers to have bluestone caps 3 in. thick size of piers.

Cellar Bottom.—To be leveled off and concreted 3 in. thick with cement, sand, and gravel, floated off on top.

Lathing.—All lath used must be the best St. John spruce lath, laid one-quarter inch apart, with 4 nailings to the lath and joints broken every 18 in., no lath put on vertically. Back of all chimneys to be lathed and plastered.

Plastering.—All walls and ceilings in 1st, 2d, and 3d stories to be plastered three coat work in the best manner, closets and attic one coat and skimmed. Cellar ceiling to be lathed, and plastered one heavy coat plaster. All plaster to extend down to the floor. Scratch and brown coats composed of clean sharp sand, goat hair, and lime. Lime run through sieve, hard finish composed of lump finishing lime, plaster, and white sand. All walls, ceilings, and angles to be perfectly straight, true, and level, browning kept well up to grounds. Patch up after other mechanics, and leave plastering in complete order on completion. Finish arch with beads in angles. Put up three centers worth $1.50 each. Furnish rough material for setting range grates, hearths, and tile.

Cesspool, etc.—Build cesspool 6 ft. diameter, 8 ft. deep in the clear, and privy vault 4 ft. × 4 ft. × 4 ft. deep, both with 12 in. dry stone walls. Privy vault to have two courses brick on top laid in mortar. Cesspool to have bluestone octagon flag 3 in. thick with iron cover.

Whitewashing.—Stop-point and lime-whiten the walls and ceiling of cellar.

Deafening.—Fill in with mortar the floors of all bay windows and projections that extend out beyond cellar.

Cistern.—Build a cistern 8 × 8 ft., 4 in. brick walls and bottom arched over at top with manhole, cistern to be cemented tight, and warranted tight for one year. Cistern covered with octagon flag 2 ft. × 2 ft. square, with iron cover. (If the place is supplied with water from water works, no cistern will be required.)

Timber.—Sill and corner posts 4 × 6, entertie tie-beams and plates 4×4, girders in cellar 4×8. Each tier beams 2 × 9 inches, 16 inch centers, double for trimmers and headers, tail beams mortised into heads. Rafters 2 × 6, 2 foot centers, hips and valleys 3 × 7 inches. Piazza sills 3 × 6 inches, 2 × 6 timbers, 2 foot centers cut in between. All studding 2 × 4 inches, sixteen inch centers, doubled at openings, and partitions set with sill and plates. Framing to be done in the best manner, well nailed and stayed. All timber to be of sound and thoroughly seasoned white hemlock, free from shakes and other defects. All partitions to be thoroughly braced, each tier of beams to have two rows of herring bone bridging.

Furring.—Do all furring required to lath, to furr off under side of all stairs, and form segment arches where shown. Furr off attic for breast and first story stone wall.

Inclosing.—The entire frame from sill to plate, including roof, to be inclosed with hemlock boards, squared edges, covered with Eureka sheathing paper and (except gables) clapboarded with No. 1 beveled 6 inch clapboards, well lapped, carefully nailed, nails set. Gables, tower, and belt to be covered with sawed pine shingles to be cut ornamental.

Shingles, etc.—All roofs to be shingled with 18 inch sawed white pine shingles, best quality, nailed to 1 × 2 spruce shingle lath.

Outside Trimming.—Water table 1¼ inches × 6 inches, beveled on top and tongued for siding. Corner boards 1¼ inches × 3 inches. Belt courses 1¼ inches by 3 inches. Moulded cornices, and gutters built in cornices. Eaves of seven-eighths inch narrow matched and beaded white pine. All details to be made as per working drawings of second quality seasoned white pine, free from loose knots or sap.

Floors.—1st, 2d, and 3d story floors laid with first quality narrow white pine flooring, 5½ inches wide, blind nailed. Two nails to each bearing. Do all cutting away for plumbers and other mechanics. Piazza flooring first quality narrow pine, free from sap, and joints leaded. No butt joints.

Windows, Window Frames, Sash and Blinds.—Plank frames for cellar windows as usual, one and a quarter inch sash, American glass. Outside casing 1¼ inches × 3 inches, jambs 1¼ inches, parting strips ⅝ inch by ½ inch, outside stops 1¼ inches × ¾ inch, inside stop ⅝ inch. All other sash 1½ inches thick, glazed with first quality French sheet, hung with hemp cord, iron weights, and iron axle pulleys; sash secured with patent window fastening. Sash made of seasoned white pine, oiled. Casements sash to have domestic fasteners, stained glass where shown to cost $1.60 per square foot. All windows to have 1¼ inch outside blinds, rolling slats, hung with malleable iron blind hinges and strong fastenings, to be painted two coats by blind maker. Inside Venetian blinds in bay windows.

Doors, Hardware, etc.—For height, width, and thickness of all doors, see plans. Front door glazed in upper part with rolled cathedral glass. Doors made of seasoned clear white pine, free from all knots and stains for oil finish. Sliding doors, 2 in. thick; closet door, 1¼ in. thick; other doors, 1½ in. thick. All four-panel. Drawers underneath counter shelf in pantry to have locks. All casement sash to hang with iron butts to open out, and secured with the Domestic Fastener and Adjuster, outside cellar door and all batten doors hung with T hinges, cellar door to have padlock. All double hung sash to have 2 inch patent axle iron pulleys, iron weights, and best hemp cord, secured with the patent sash lock. All doors to have ⅝ inch beveled saddles of ash. Hardware will be of the Gilbert patent bronze first floor, balance porcelain. 3 in. × 4 in. mortise lock, 3½ loose butts. Improved

* Mr. Baker will be happy to answer any questions or give any information that may be desired by our readers, and he is prepared to furnish working drawings and specifications and full size details, and superintend the erection of these cottages.

sash fastenings. Front door to have night works complete. All necessary clothes hooks.

Stairs.—See details. To have 6 inch newel, turned ball on top, angle posts 4, chamfered and pointed both ends, 2 inch × 3 inch moulded rail, 1½ inch turned balusters, all of seasoned ash, well cleaned down. Threads and strings 1¼ inches, 12 inches wide, risers ⅞ inch, 7½ inches high. Nosings and cove returned on strings. All glued, blocked, and wedged, and to have 2¼ inch × 4 inch carriages. Stairs to attic to correspond to main stairs, all pine, to have 1 inch treads, strings, and risers. Stairs to be got out of seasoned white pine, made and put up in a substantial manner. Put up smooth pine steps to cellar, and 1¼ inch pine threads and strings.

Inside Casings.—All inside doors to have 1 inch jambs with ½ inch moulded strip to form rabbet, all well blocked for hinges. All doors and windows to have ⅞ inch beaded casing 5 inch wide, as per detail, with back moulding, closets and attic ⅝ inch plain casing 4 inch wide. All windows trimmed on to moulded stools with 3 inch beaded aprons below. The above trim for parlor and sitting room and hall to be of seasoned white pine, smooth and free from knots or other defects, for oil finish, first and second floors; painted in attic.

Base.—In 1st and 2d stories, except closets and kitchen, put down plinths 8 inch high, beaded same as trim, and one base moulding, all scribed to floors and well nailed, and of same quality and kind of lumber as trim. Attic base plain ⅞ inch × 6 beaded.

Angle Beads.—All plaster angles to 1½ inch turned angle beads.

Closet Work, etc.—Put up 2½ inch strips for wardrobe hooks, where directed. All shelves put up on strong rebated cleats; shelve closets as follows: All closets to have two rows of shelving and one row of japanned double hooks. Butler's pantry fitted up with counter shelf 20 inches wide below, with three drawers underneath on one side, and two doors on opposite side, with sash doors to slide above. In kitchen, wainscot above sink two feet high around to window neatly capped, to be done with ⅞ narrow matched and beaded pine. Put drain shelf to sink. Bath room wainscoted 3½ feet high on all sides with ⅝ inch narrow matched and beaded white pine capped, front of tub, W. C. & W. B., same closet under W. B. door hung and secured with button, cap of tub, seat and lid and W. C. one 1¼ inch stuff; lid hung on brass hinges. Build coal bin, capacity 10 tons, in cellar, also pantry in cellar as directed.

Rear Piazza and Bay Window.—Round off flooring and front edge and finish with cove and facia. Fill in between piers with ¼ × 1½ inch lattice. Plate 2 × 3 inch let into posts, finish under plate over doorway with 1½ inch rail, moulded, finished with clapboards. Form moulded gutter in cornice, ceilings boarded with ⅝ inch narrow matched and beaded pine, shingled as per main roof; steps same as floor, and strings 1¼ inch; risers ⅞ inch. Rear porch to have strong floor timbers, 1 inch floor, steps and risers, not inclosed, roof of same shingled, and supported by brackets or posts.

Mantels.—Will be provided by the owner; must be put up by carpenter.

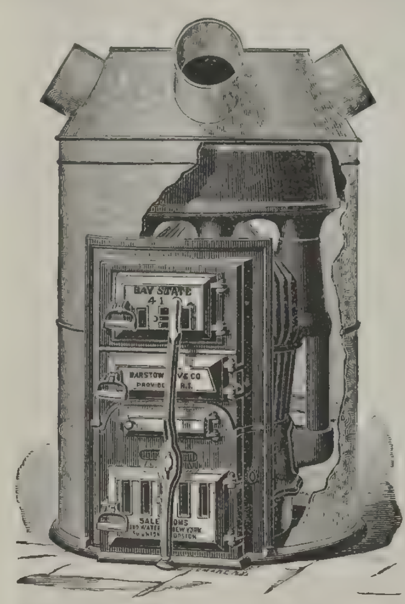
Clothes Posts.—Furnish and set for house four chestnut turned posts; set 3 ft. in the ground.

Privy.—Four and a half feet square, double faced matched boards, battened, shingle roof, plain spruce frame, ceiled overhead, battened door with thumb latch and bolt, 4 light sash, strong floor timbers, wide floor, seat with two holes, 1 child's seat, lids chamfered and hung. Build outside cellar doors complete. Build two wash trays of 2 in. lumber with lids and legs complete, lids hung on brass hinges; inside measurement of tubs to be: depth, 16 in.; width, 22½ in.; length, 26½ in. high; supplied through nickel plated patent cocks, to have plug, chain, etc., complete. Furnish, fit up, and connect one wash out water closet with white earthenware bowl, and drip porcelain supply tank above.

Painting.—Outside woodwork to have two coats of best Atlantic white lead, and linseed oil in three colors, roof stained. Interior, one coat of filler and one coat of hard oil.

Tinning and Plumbing.—Furnish all necessary flashings for windows, valleys, etc., line gutters, and do all tinning required by the drawings, also furnish and put up 3 in. tin leaders where shown. Supply pipes, AA, ⅝ lead.

Waste.—Run 4 in. cast iron soil pipe from drain, at least 3 ft. outside cellar wall and 4 ft. above roof, finished with ventilator. To have necessary branches, etc.,



BARSTOW'S BAY STATE FURNACE.

joints calked with molten lead; sink, bath, and wash bowl waste through 1¼ in. D pipe. Sink and wash bowl to have S traps with screws. Bath waste to run to water closet trap. Sink waste to drain into main pipe at cellar. All pipes to be thoroughly tacked to boards and between beams packed with mineral wool. Plumbing to be guaranteed for one year. Two wash tubs and connection in kitchen, with hot and cold water with waste.

Gas Fitting.—Run all necessary gas pipe of suitable size for outlets as shown and in accordance with rules and regulations of the gas company.

Bell.—At front door 4 in. gong.

Furnace and Range.—Furnish and put up in cellar one No. 36 Boynton Climax portable furnace complete; pipes running through floors to have tin collars and be well protected where required, [to have tin register boxes, casings, and black japanned registers, with frames set in walls were practicable. Furnish and set in kitchen a No. 8 Bristol range with water back complete, Boynton Furnace Co.'s make.

Plumbing.—Connect with city water in cellar and run ⅝ in. AAA pipe throughout for all connections. (If no city water, line a tank 6 ft. x 4 ft. x 4 ft. in attic to supply bath, sinks, boiler, closets, and tubs.)

Kitchen.—Furnish and set in kitchen one 18 x 30 cast iron sink with legs, supplied with hot and cold water through ⅝ in. patent brass cocks. Furnish and set one 30 gallon galvanized boiler connected with water back of range. Put in sediment cock to boiler. Run circulating and escape pipe from boiler.

Pump.—Furnish and set complete a Coleman ship pump in kitchen, supply tank from cistern also direct to sink. (This pump is not necessary if city water is used.)

Bath Room.—Furnish and set one 5½ ft. 14 oz. French pattern copper planished overflow tub, supplied with hot and cold water through ⅝ in. nickel plated patent cocks, to have nickel plated plug, chain, etc. Furnish and fit up 14 in. marble style overflow basin, 1¼ in. moulded and countersink slab, 1 in., moulded base, 6 in.

BARSTOW'S BAY STATE FURNACE.

The Bay State Furnace, here illustrated, is sure to meet the demand for a very powerful cast-iron furnace, so constructed as to be absolutely gas-tight and crack-proof.

The long experience of the Barstow Co. in the manufacture of furnaces, and the close study of the working of everything in this line, has resulted in the production of the Bay State. The form of the dome is such that it precludes the possibility of cracking from expansion. It is arranged with patent oscillating center dumping grate, with upright shaker, doing away with the old back-breaking method of shaking furnace grates. It is also provided with dust flue and check damper, an improvement seldom found in cast-iron furnaces. It has an immense radiating service, and is altogether the most powerful furnace in the market.

Made by the Barstow Stove Co., 230 Water St., New York, 56 Union St., Boston, and Providence, R. I.

No. 3 UNIVERSAL ENGINE LATHE.

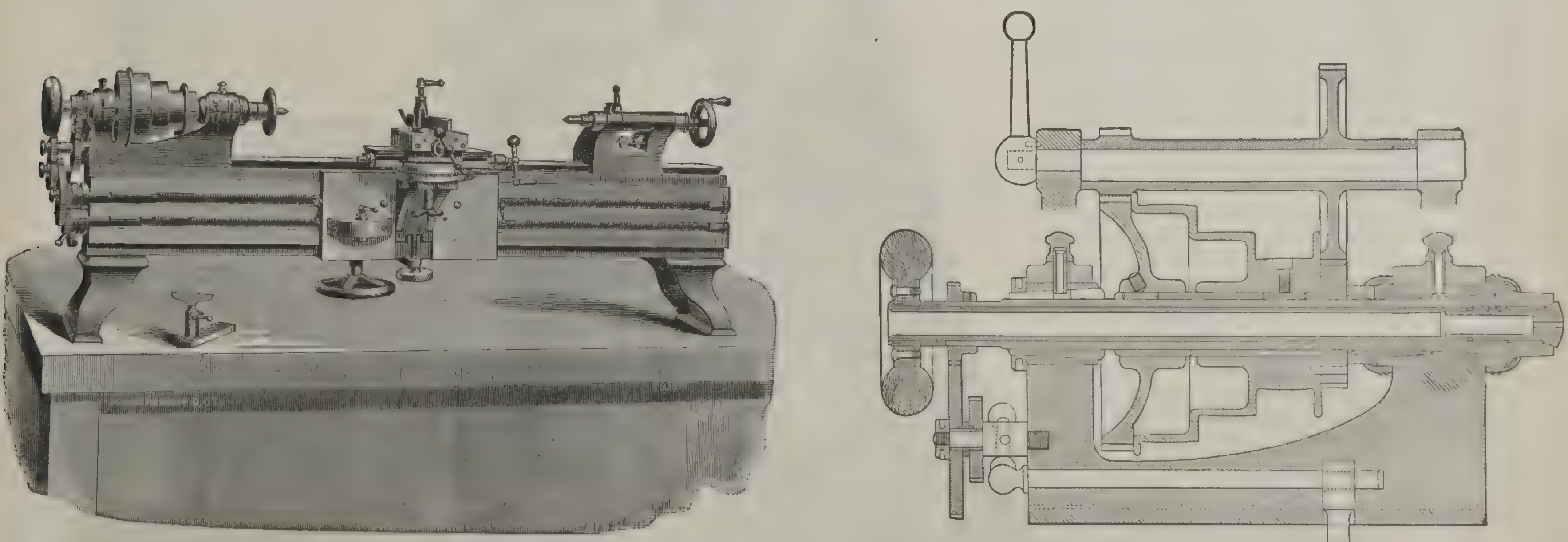
From its peculiar construction, this lathe is something novel as compared to the standard patterns usually manufactured. It has many features of excellence, and among them a *precision* leading screw, which has had microscopic inspection while being cut, correcting in the process the minutest errors, so that a lathe with such a leading screw cannot but produce extra fine screw cutting. In order that the precision screw shall retain its accuracy, the lathe has a second leading screw for feed, while turning, and for ordinary screw cutting.

The spindle of the head is hollow, made of steel, also the boxes, and both the spindle and the boxes are hardened and ground to bearing, the front being a taper bearing. The cut of the sectional view of the head shows the arrangement of the spindle, etc., and for convenience the back gear is shown on the top instead of in actual position.

By the use of two translating gears both the English and metric threads can be cut from the same set of change gears.

The carriage is on the side of the lathe, and with the slide rests can be moved to any part of the bed. This gives the same swing over the carriage as over the bed, 7 in., so that the lathe admits of a great variety of work, especially with the fixtures.

The slide rest is very complete, and its direct vertical adjustment of two inches is important and convenient; by this the cutting tool can be adjusted, then raised and lowered without readjustment. A large graduated base admits of cutting at any angle, and the cross and angular feed screws have micrometer heads reading to thousandths of an inch, so that all positions of the slide rest admit of fine adjustment. We can say that the lathe is a fine specimen of first-class workmanship, and the makers claim it especially adapted for model work, fine tool making, or for general use. It is manufactured in the mechanical department of the Waterhouse Electric and Manufacturing Co., Hartford, Conn.



THE UNIVERSAL ENGINE LATHE.

Powdered Resin is the best thing to stop bleeding from cuts. After the powder is sprinkled on, wrap the wound with a soft cotton cloth. As soon as the wound begins to feel feverish, keep the cloth wet with cold water.

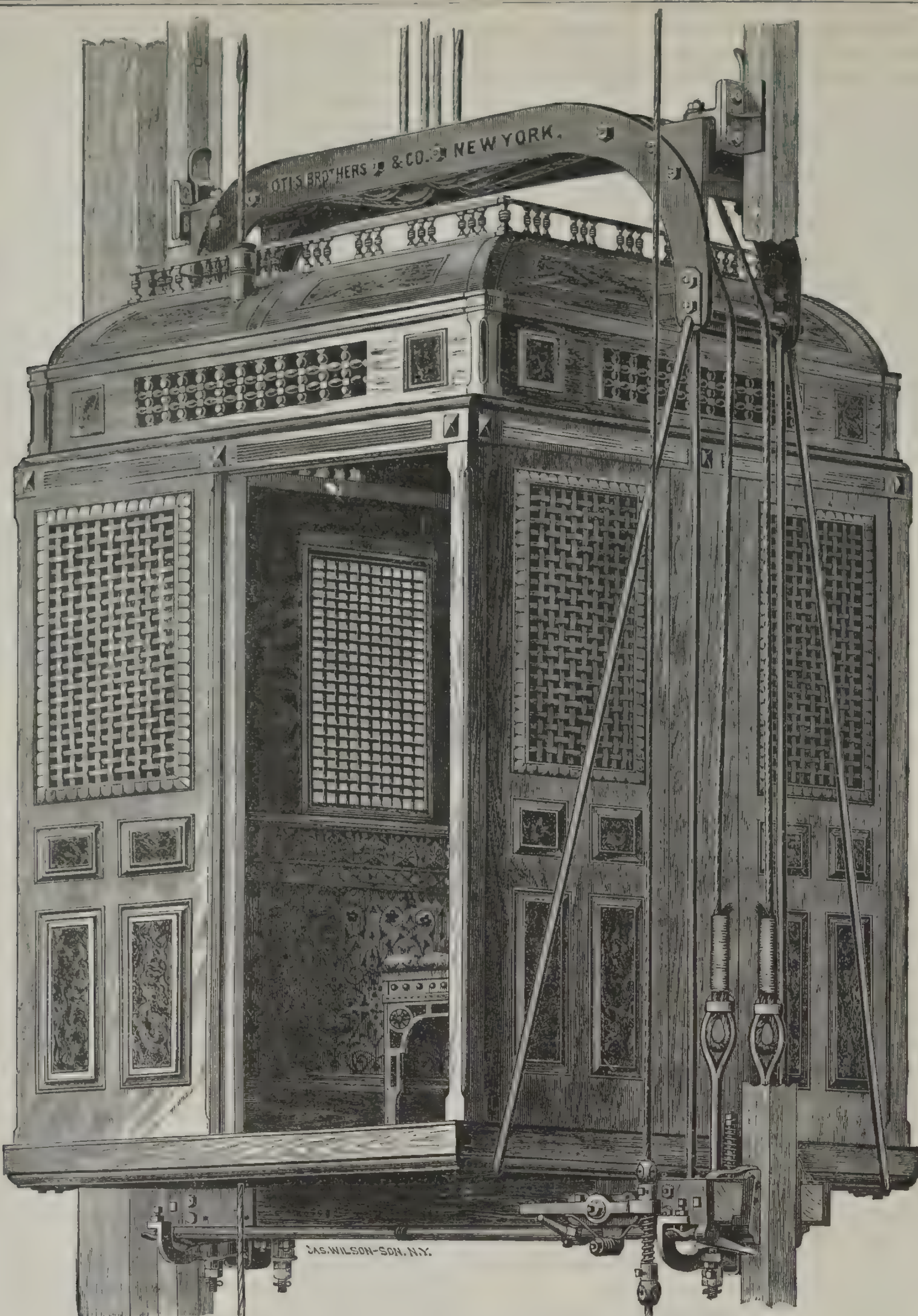


Fig. 1.—THE OTIS ELEVATOR PASSENGER CAR.

THE OTIS ELEVATORS.

To no other department of manufacture is attached so grave responsibility as that of elevator building. A machine that is never put in motion except to lift or lower human beings or property should be safe beyond all doubt or question, and we assume no one would knowingly buy or use an elevator falling short of this standard.

In dealing with the problem of how best to attain and maintain such a standard of excellence, Messrs. Otis have followed two cardinal principles: First, to make such machine, with its car or platform and their connections, intrinsically safe, independently of any special safety devices; and, second, to add to the apparatus so built such devices, adapted to the particular kind of service, as would best control and regulate its operation, prevent undue speed, and guard against any conceivable accident or result of carelessness in operation, or negligence in the care of the elevator. In the case of the Otis standard hydraulic passenger elevators, which are now generally employed for the best class of passenger elevator service, they so build each machine that its power is absolutely exhausted the moment the car reaches its upper or lower landing. The car must, therefore, securely stop at one or the other of these points, independently of the action of any safety device, independently of the operator, and whether the hand rope or other means of regulating the movement of the machine from the car be in perfect order, or broken or destroyed while the car is in motion.

Each machine is connected with the car by two solid metal piston rods and at least four wire cables, any one of which is capable of sustaining a weight largely in excess of the maximum load to be lifted by the elevator.

In addition to providing the simplest and best forms of appliances for starting and stopping this elevator, there is placed under each car a safety platform, to which every lifting cable is independently attached, and to this platform is also connected, by a wire cable, an independent safety governor. In case of the undue stretching or breakage of any lifting cable, or should the car, from any cause, attain a degree of speed beyond the rate fixed by the governor, the safety apparatus brings the car, gradually but unfailingly, to a full stop, and securely holds it at or near the point in the shaft where such apparatus is brought into action.

The makers confidently claim for this elevator that it is by far the safest which has ever been built; and they are able to say, of the countless millions of passengers who have been carried by their passenger elevators (both hydraulic and steam), not a single one has suffered loss of life or limb from any accident to any of such elevators, during the entire period of thirty-four years which they have devoted to elevator manufacture.

The majority of architects, builders, and owners of buildings need no suggestions regarding the general specifications of elevator service. But we are disposed to urge upon all the importance of determining, before beginning building operations, the particular elevator apparatus, in all its details, with which the building is to be provided.

The special data required by Messrs. Otis as a basis for estimating the cost of any particular type of elevator will be furnished on application; and, if desired, they will also, wherever practicable, send one of their representatives to advise as to the kind and capacity of machine best adapted to the proposed service, including location, erection, or maintenance.

It would be difficult to find any superior examples of mechanical construction than those regularly employed by Messrs. Otis. They are so excellent that we have chosen a few specimens for illustration.

Fig. 1 shows the Otis passenger car with safety frame. The framework is constructed entirely of wrought iron; the lifting cables pass through it, and are connected independently to the gravity wedge safety apparatus under the car, as shown.

The gravity wedge safety apparatus locks the car firmly to both guide rails on the undue stretching or breaking of one or more of the lifting cables.

The illustration also shows the cable connection of the safety governor, which brings the gravity wedge safety into action in case the car, from any cause, should attain undue speed. We also show the position of the wedge safety ready to act as indicated.

The makers have over a hundred special designs of passenger elevator cars, ranging in price from two hundred to two thousand dollars, which are built of various woods. The value of the car shown in our illustration is one thousand dollars.

Fig. 2 shows the passenger elevator engine. Recently Messrs. Otis have added the rubber buffer attachment, which is designed to relieve the car from shock

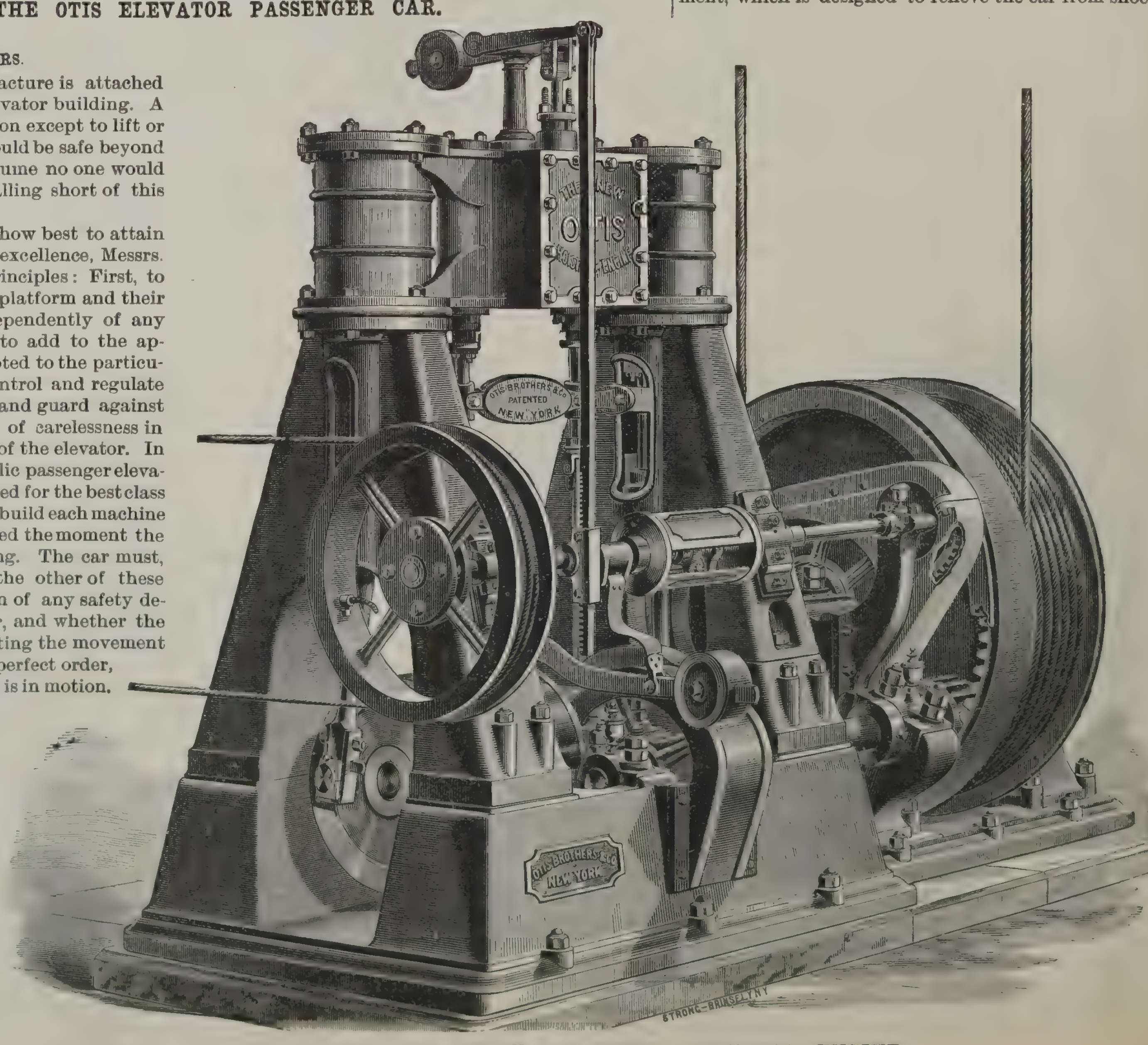


Fig. 2.—THE OTIS STEAM PASSENGER ELEVATOR ENGINE.

or jar when starting or stopping, and to insure smoothness of motion in running at high speed. This device is patented, and is used exclusively on the Otis elevators.

Several sizes of these engines are made, adapted to various capacities, with two or more lifting cables.

In connection with this engine, they employ their regular safety car frame and gravity wedge safety apparatus, also the safety governor.

The demand for a hydraulic hoist, in connection with steel manufacture, has induced Messrs. Otis to bring out their standard hydraulic freight elevator, which is shown in Fig. 3, as constructed for cupola hoisting.

This form of machine is intended for any duty, and to be operated under a water pressure of from thirty to five hundred pounds. The simplicity of construction will at once commend it to engineers. Two or more lifting cables are employed, with standard safety attachments on the platform.

Fig. 4 shows the Otis hydraulic machine, with direct pumping system, adapted to passenger and freight service, and is specially designed for any building where it is not desirable to place a tank on the roof or in the attic. Its operation is to pump under pressure directly on the piston. The water from the cylinder is discharged into the tank, and is used over again. It occupies very little room in the basement, and is simple in its construction and operation.

Further information can be obtained from the manufacturers, Messrs. Otis Brothers & Co., New York.

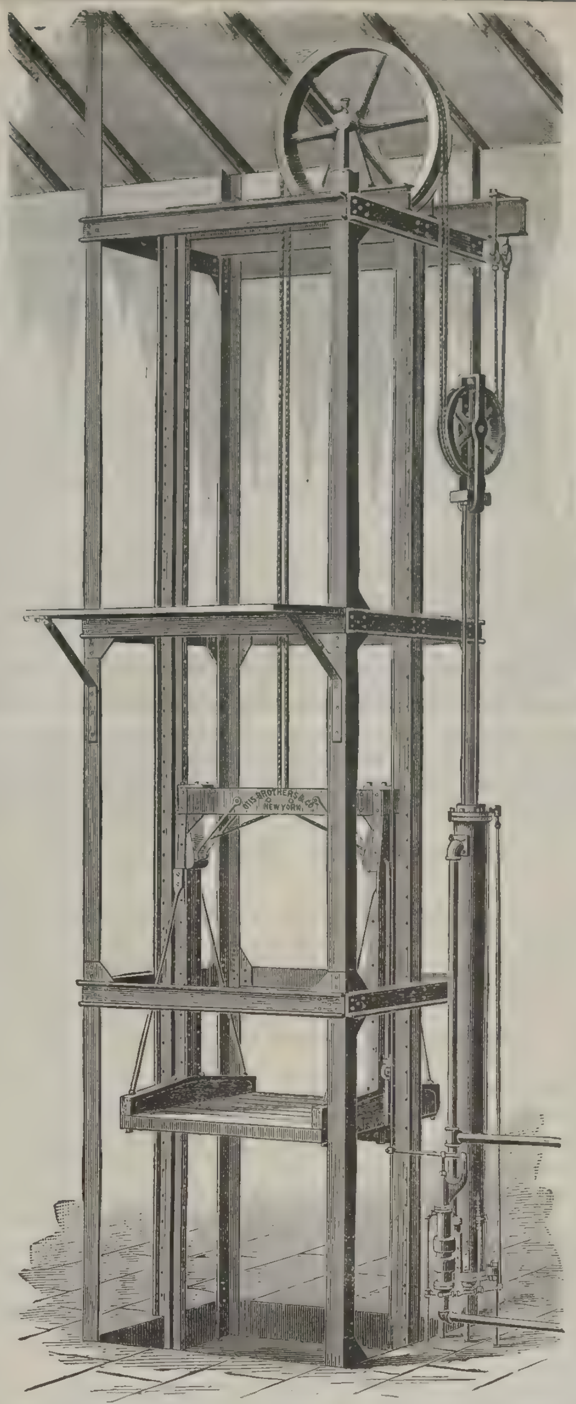


Fig. 3.—THE OTIS HYDRAULIC HOIST, OR FREIGHT ELEVATOR.

The Car Coupling Question.

The discussions which have followed the committee work of the Master Car Builders' Association on freight couplers have brought out very clearly the difficult nature of the problem involved. It has developed that the trouble is not so much to get an efficient, mechanically correct coupler, as to get one that, while coupling perfectly with others like itself, will also couple perfectly with others that are unlike to it. Affairs have taken such a shape that the "coming coupler" must, while coming gradually into final general use, be called upon to couple not only with the old link and pin, but also with several improved devices of both the link and pin and hook types. This requisite of coupling with others unlike to it was at one time expected to be brought into play only when encountering the ordinary old fashioned link and pin draw bar. To meet this requirement it was perceived that the exercise of considerable ingenuity upon the part of the inventor would be called for; but still the problem was not considered one of insuperable difficulty. While waiting for the ultimately successful coupler, however, a number of devices laying claim to that distinction have not only been brought forward, but have been placed in a constantly expanding use. Especially within the last twelvemonth have certain improved couplers of varied pattern and principle of action been placed in service to large extent. The situation is thus immeasurably complicated. The single additional requirement of coupling with the old fashioned draw bar, beyond coupling with itself, is now expanded to include perfect and safe coupling with several patterns and types of couplers now liable to be encountered with increasing frequency. These difficulties cannot be made light of, and they are gaining an importance in the minds of inventors, and of the more thoughtful railway men, that transcends that of the original difficulties of obtaining a practical coupler or of obtaining one that would operate with the old link and pin.

The more carefully and thoroughly does the railway man go over the ground, the less able and more reluctant does he become to indorse the link and pin principle over the hook principle, or *vice versa*. The outcome of this matter, judging from present tendencies, will probably be that individual adoptions will increase in number, and that by the time the Car Builders' Association gets around to official indorsement of a given coupler or couplers, it will be able only to recommend those that will be at that time already in practical service to considerable extent. As those that will be thus found to be in service will be largely varying in pattern and principle, the Association will find that the chief good that it can do will be to exert its influence with the inventors of the various patterns to modify their devices so that they will intercouple with reasonable safety and ease. Beyond this the car coupling problem, which seems to have taken its own solution into its own hands, will have to work its destiny out alone.—*Railway Review.*

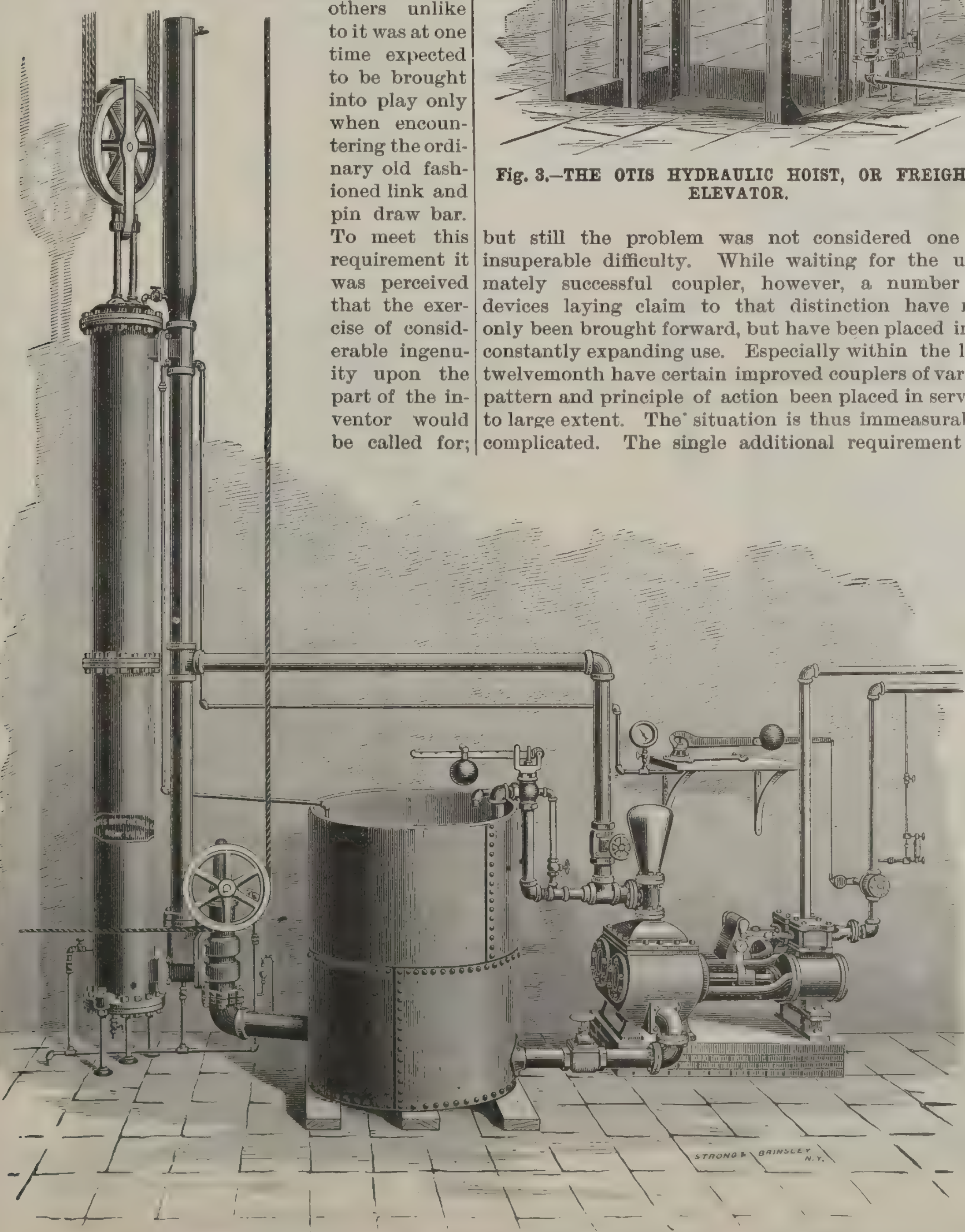


Fig 4.—THE OTIS HYDRAULIC MACHINE. WITH DIRECT PUMPING SYSTEM.

THE MILLERS FALLS BORING MACHINE.

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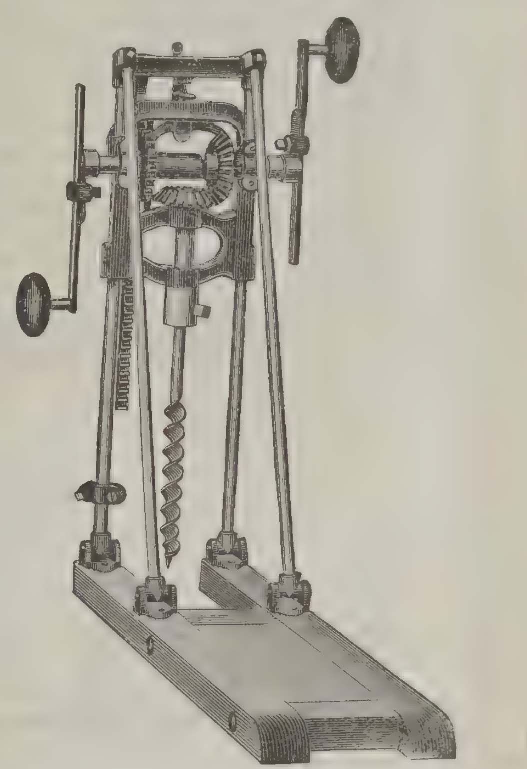


THE MILLERS FALLS BORING MACHINE.

other kind in use. The frame is made of half inch round steel rods; the braces are the same, and attach to the rods at the top by a set screw. When this set screw is loosened, the frame falls over so as to bore at any desired angle.

The depth of hole to be bored is fixed by a stop, as seen on the left hand upright rod in the cut. When the frame strikes this stop, a latch is lifted, and the machine throws itself into gear by the use of a spring, and the auger is lifted out of the hole by continuing to turn the crank in the same direction.

When the auger is drawn from the hole, the frame hangs itself up until the machine is moved to the next hole; then it is dropped down by turning the crank back until the auger strikes the wood, when it is thrown out of gear and proceeds to bore the next hole. As seen in the cut, the machine has adjustable cranks, which fully regulate its speed and power.

The gears are all cut, which is not common in other machines.

The company does not desire the reputation of making the cheapest goods in the market, but they mean to deserve the name of making the best. Made by the Millers Falls Co., 74 Chambers St., New York.

South Carolina Phosphates.

One hundred and fifty-one thousand nine hundred and ninety-six tons of phosphate rock were mined in South Carolina during the twelve months ending Aug. 31, 1885, or an increase of eleven thousand tons over the preceding year. The beds under the Coosan and Bull rivers, in Beaufort County, supply the larger portion of this amount, and are now more productive than the formerly famous fields for sea island cotton.

A Handsome Compliment.

Our excellent contemporary, the *American Architect and Building News*, makes the following courteous allusion to this publication. Among the wholly new journals, says the editor, is the ARCHITECTS' AND BUILDERS' SUPPLEMENT of the SCIENTIFIC AMERICAN. This new departure we can understand, and can perceive that its success is assured, not only because of the mass and character of the information that comes under the eyes of its editors, but because its publishers already have their fingers on a large class of men who have not time to read much, but who know enough to read the best; and surely, for the mechanics of this country there is no better paper than the SCIENTIFIC AMERICAN and its several SUPPLEMENTS. Of the new one it is enough to say that it is recognizable as a chip of the old block, and that its distinguishing feature is a colored plate, which in its execution is much superior to what is usually found in such publications.

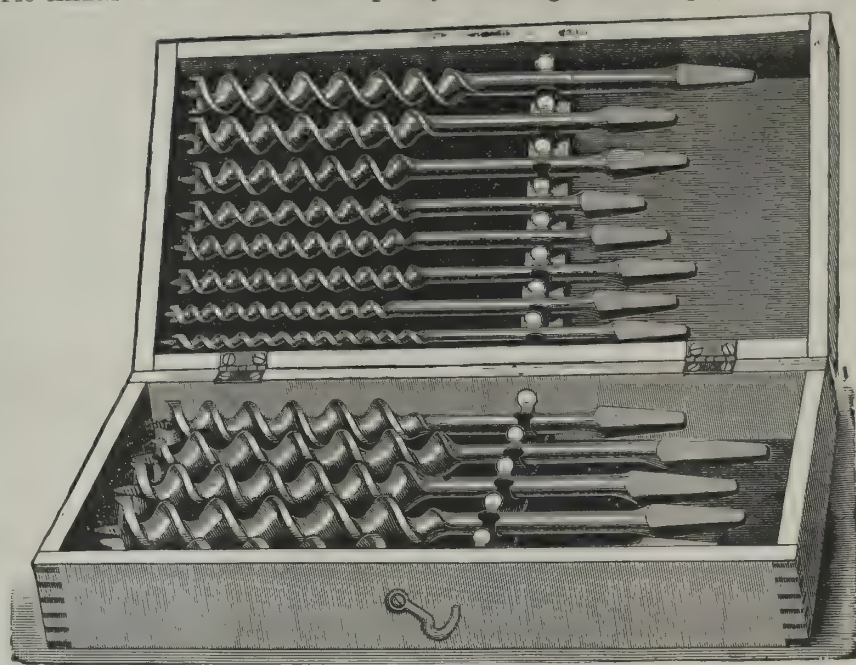
Salisbury Steak.

The Salisbury steak is made by taking the best slices of the "round" on the beef, and chopping it with *dull* knives. The object is not to cut, but rather pound the meat. By thus treating it, the pulp comes to the top, and the tough, fibrous portion remains below. This pulp is scraped off and made into cakes, like sausage cakes, or into the shape like a good sized steak, and *gently* broiled on a gridiron. It has been found that meat gently cooked is more digestible than raw. The fire must be good, so that the meat may be rapidly broiled, that is, be cooked on the outside and almost raw inside.

A little salt and pepper and a small amount of butter added make a not at all unpalatable dish, and one which contains *all* the strength of the beef, with the tough, indigestible portion entirely separated. This diet is used exclusively in chronic cases by physicians professing to treat according to the Salisbury method. They use but few drugs, and what they use are mainly tonics. The diet is used not only in diseased digestion, but diseases of liver, kidney, stomach, bowels, nerves, etc., and remarkable results are said to have been obtained.—*New York Medical Times.*

IMPROVED AUGER BITS.

One of the neatest arrangements for auger bits is that of Messrs. C. E. Jennings & Co., 69 Reade and 87 Chambers St., New York, illustrated in our engraving. Like all the goods of this house, the tools themselves are of the first quality. The auger bits are put up in wooden boxes, with a special spring rack for each size, so arranged that each bit may be quickly slipped into its place and will be firmly held there; and may be readily removed when required for use.



THE JENNINGS AUGER BITS.

Treatment of Freckles with Carbolic Acid.

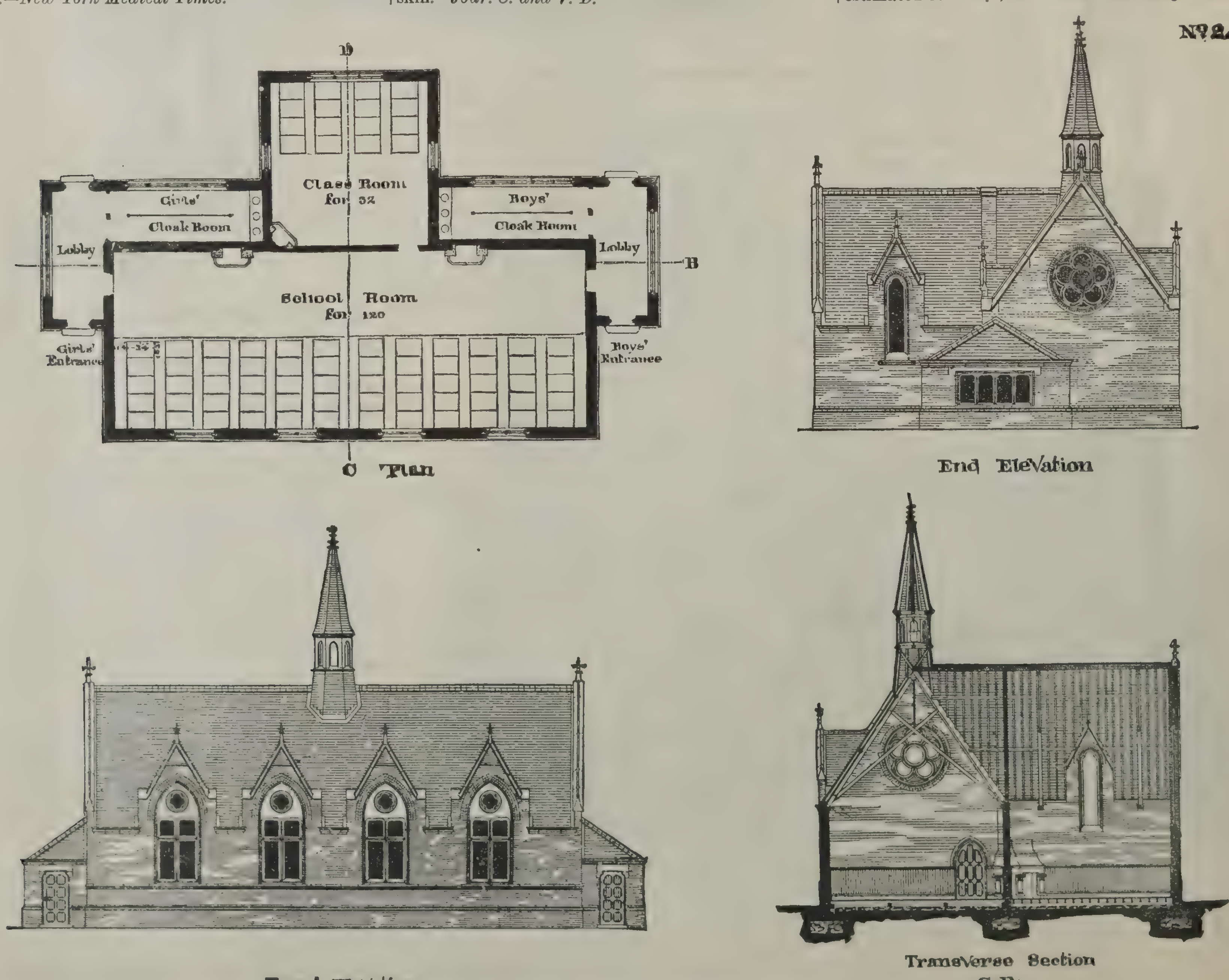
Dr. Halkin's procedure is as follows: The skin being washed and dried is put on the stretch with two fingers of the left hand, and a drop of pure carbolic acid is applied exactly over the patch. When it dries, the operation is completed. The skin becomes white and the slight sensation of burning disappears in a few minutes. The thin crust which forms after the cauterization should not be disturbed; it detaches itself spontaneously in eight or ten days, leaving a rosy coloration, which is soon replaced by the normal color of the skin.—*Jour. C. and V. D.*

Oil Seeds of Egypt.

Several plants are grown in Egypt for the sake of their oleaginous properties, the principal being as follows: *Sesame*, or *Semsem* (*Sesamum indicum*), is cultivated in Central Egypt on a large scale, being sown in June and harvested in autumn. The stems are pulled up bodily, and conveyed in an upright position to suitable spots; as soon as the capsules are dry they open in the sun, and shaking them suffices to dislodge the seed. The oil obtained by pressing the seeds is thin and yellow, and serves largely in cooking, though liable to rancidity; when purified, it is a good illuminant. The castor oil plant, or *Kharoua ahmar* (*Ricinus communis*), attains the proportions of a small tree, and produces much oil, especially in Fayoum. An oil-yielding lettuce (*Khass*) is grown about Edfou, and in the southern part of the province of Thebes; when ripe, the plant is cut, dried, and thrashed, the seed affording a pale yellow, very sweet oil, used in cooking. An oil yielding radish (*Symagah*) is grown for its seed, the oil finding application in the arts. The ground nut, or *Ful sennari* (*Arachis hypogæa*), requires a light soil into which it can thrust its seeds for maturation; the oil obtained from them may replace that of the almond, while the roasted nuts themselves are good eating, and serve instead of hazel nuts in pastries. Garden cress, or *Richad* (*Lepidum sativum*), in Upper Egypt, affords a seed oil, while the young plants are used in salad. Mustard, or *Khardal*, is similarly utilized, and colza, or *Selgam* (*Brassica campestris*), is grown solely for its seed oil. The seeds of the safflower, flax, and cotton are all pressed for their oil in Lower Egypt; while the opium poppy (*Papaver somniferum*) and the heliotrope turnsole (*Heliotropium europæum*) are similarly utilized in Upper Egypt.

A VILLAGE SCHOOL HOUSE.

We illustrate a design for a village school by Mr. H P. B. Downing, architect. These schools are intended to accommodate 150 children, and have separate entrances and cloak rooms for girls and boys. The building would be executed in red brick, with stone dressings, and covered with tiles or green slates. The estimated cost is $5,000.—*Build. and Eng. Times.*



DESIGN FOR VILLAGE SCHOOLS. (Scale, 16 feet to the inch.)

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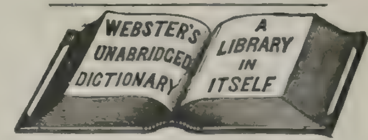

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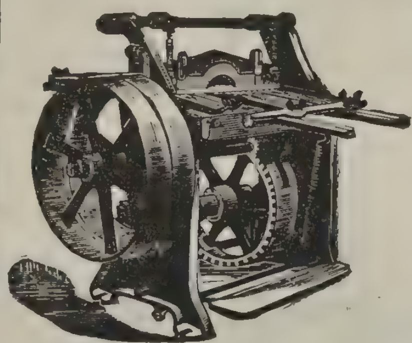

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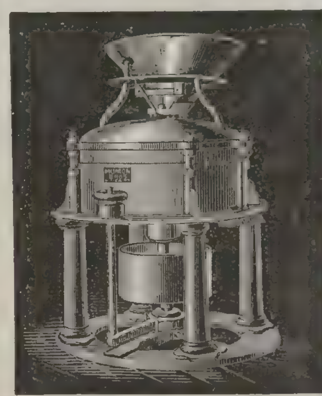

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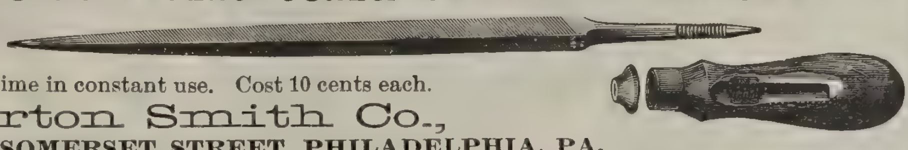

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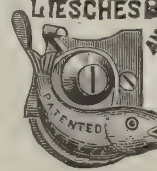

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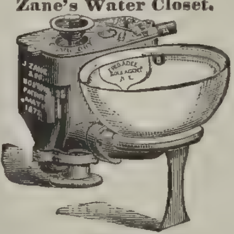

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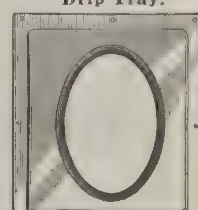

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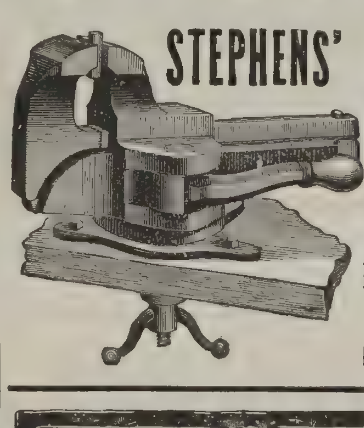

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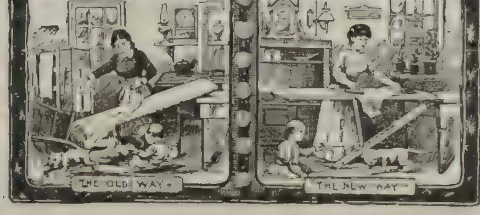

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HOUSE AT ST. GEORGE'S HILLS, WEYBRIDGE.

THIS house is being built among the pine woods on the newly opened up St. George's Hills Estate, which makes Weybridge one of the most favorite neighborhoods within twenty miles of London. The wall facings are of orange-red Bracknell bricks and red tile hangings, the half timbered gables and tympanum over porch being filled in with cement ornament in relief, and colored with Indian red and yellow. The roof is covered with brown Broseley tiles. The entrance hall, staircase hall, and staircase landing are to be handsomely fitted in the Jacobean style, and the sanitary work is under the superintendence of Professor Corfield, of London. The architect is Mr. W. H. Seth-Smith, M.S.A., of 46 Lincoln's Inn Fields, London, and the builder, Mr. S. Woods, of Weybridge.—*Building News.*

W.H.Seth-Smith. Architect. 46·Lincolns·Inn·Fields·W.C.

BUILDERS' QUANTITIES.

THERE is generally a considerable difference to be noticed between an estimate prepared by a builder from a set of drawings and a specification and one which is based upon bills of quantities prepared by a regular surveyor. It is often assumed that a builder can sail nearer to the wind than a surveyor; that he is not under the same necessity for allowing margins of safety, and that, in fact, as he makes any omissions at his own risk, he knows how to compensate himself for such lapses of forethought. Hence, in small works, when an estimate has been accepted on a builder's own quantities, the architect is more than usually on his guard against making allowances for extras. When there is a disagreement in such cases, the amount in dispute is often so trifling that the builder ends by yielding the point and accepting the architect's award. If the architect be a fair-minded man, he will endeavor to adjudicate impartially between the builder and the building owner, allowing the interests of neither to gain any undue ascendency. This, however, is an extremely difficult thing to do. Setting aside the fact that an architect's own interests are mainly identical with those of his client—a fact which, it is fair to say, does not influence the conduct of most professional men—how does the question usually present itself to the mind of an architect? On the one hand, there is the client, a man unversed in the technicalities of building, and therefore completely at the mercy of those acquainted with all its mysteries. On the other hand is the builder, with his own special, practical knowledge, which on some points may exceed that of the architect, and with one object before him—that of carrying on his business with the greatest amount of profit to himself. It is then assumed at once that the client alone stands in need of protection; and so it often happens that an architect becomes virtually his client's advocate, instead of maintaining a judicial attitude between him and the builder.

When a builder commences making an estimate without a previously prepared bill of quantities, he has an amount of labor thrown upon him for which he can claim no remuneration, and which, in a competition, may prove utterly unfruitful. In taking off quantities, although he will probably adopt more simple and rough and ready methods than would be found convenient for a surveyor, his task becomes really more complex. Instead of taking off a number of dimensions, to be subsequently squared or cubed, abstracted, and brought into bill, he may be seen examining the drawings with knitted brows, going through mental calculations, and occasionally jotting down rough notes. He "lumps" many of his items, considering in his mind the quantity of materials required, the markets where they can be obtained, the cost of carriage, the amount and quality of labor involved, and the profit for which it will be worth his while to undertake the work. Such methods of procedure, so far from being haphazard, demand the exercise of more thought, and bring into play a larger amount of practical knowledge, than is generally realized. The items which are "lumped" in a surveyor's bill require an equal amount of careful consideration in pricing, but these items are comparatively few.

In estimating the cost of carving and other ornamental work, the builder often runs considerable risk, unless there is a plentiful supply of large-scale details to form the basis of his estimate, or unless he is thoroughly familiar with the style of work which the architect is in the habit of carrying out. In an open competition, when the lowest tender is to be accepted, there is little doubt that differences between estimates are often largely due to vague drawings or the absence of provisional sums for ornamental work in the specification. Marginal sketches in the latter are extremely useful to an estimator, and might be introduced more extensively with advantage, especially in these days of rapid work, when it often happens that there is not time to draw many details before the contract is signed. Architects are usually ready enough to furnish a builder with all the information they can command, and to afford him every facility in preparing his estimate; but time rarely permits of this being done in a thoroughly satisfactory manner to all concerned. Sometimes a builder is allowed two days in which to estimate the cost of a work. He cannot be expected, under such circumstances, to take off quantities, in any true sense of the words, and thus finds himself driven to adopt expedients which only very sound knowledge can make reliable. An inexperienced man who secures a contract in a competition may well doubt if he has not engaged in an unprofitable undertaking, and may even come to envy those who have given time and thought to the preparation of estimates which have not been accepted.

When an architect is carrying out a work for which the estimate is based upon builders' quantities, he should bear in mind such circumstances as we have endeavored to delineate. As a matter of fact, such estimates often come out much cheaper than those which are made from bills of quantities supplied by a surveyor. In some cases, builders have been known to make little or no profit upon the original contract, and have even sustained losses over extras and omissions. In these days of bad trade, it is indeed hard to be presented with the alternative of standing idle or of working to no advantage, and every consideration ought to be shown, in carrying out the details of a work, to those whose toils are but too seldom adequately rewarded.—*Build. and Eng. Times.*

EDUCATION IN THE UNITED STATES.

THE pride taken in popular education in the United States makes any digest of their experience valuable; and education, as carried on in their cities, the subject of a recent "Circular of Information" from the Bureau of Education, is necessarily the branch of it most interesting in our crowded island. Dr. Philbrick, the writer of it, has been, in Boston, a most successful school superintendent, an officer who undertakes the active duties of both School Board and Government Inspector, and one without whose services cities are here said to be behind the times. The uncertainty of a good choice of members for a school board by popular election in the United States makes this office the more important; women having, as a rule, declined to counteract corrupt votes by their own.

Every branch of education is treated upon here. Technical instruction, both as provided in Paris and in the United States, is largely and systematically considered—from the shape it takes in the school, where it simply replaces the gymnasium to boys over thirteen years of age, to the apprentice school, which really attempts to supersede the worn out system from which it gets it name by a more scientific and intelligent teaching of a few trades, among which building in its various branches, necessarily so important in a new country, is always one chosen. School museums are recommended, both of natural history and of technology; the decoration also of schoolrooms with statuary, etc., now provided for the purpose at low prices, a list of which is appended.

The rules to be observed in building are a digest of both European and American experience, valuable to every one concerned with the architecture of schools of any class; and we may just note Dr. Philbrick's conclusions—that increased centralization and permanency are found desirable; that *speaking* French or German is unnecessary to ninety per cent of secondary scholars; and that high school education is bad for girls. "Free and uniform" is Dr. Philbrick's ideal. He believes that the work of elementary schools can be so revised that the higher subjects will be a simple continuation of the lower, so that a complete elementary course shall be just the same as the first few years of a university education. Higher stages are never to be commenced till after the age of fourteen. Free high schools, "the most truly democratic of all our institutions," are being used by youths who go back to farm work, contending that in no way does a classical education unfit a man for manual labor and attending meetings of "old boys," whose common interest in the school helps to obliterate social distinctions.

Such schools are to be provided for the mechanic to carry on his studies therein in the evening; while for for higher students manual labor, especially the use of carpenters' tools, is to replace the gymnasium, and be pursued afterward in evening technical schools; and thus study and labor will complement each other, and the daily toil of the poor man is raised to the level of the rich man's recreation. Military and fire drill are to be taught, and replace out-door games. We fear that an elementary course complete in itself and different from university rudiments, although perpetuating class distinctions, will probably be a necessary evil for some time yet, and also that paralysis for lack of competition must be incurred where pupils are required to attend the school in their own district of their own city—thus necessitating uniformity of ˉ ooks for the sake of families removing.—*Nature.*

OUTWITTING OUR HEALTH OFFICERS.

THE small-pox epidemic at Montreal rendered it expedient that railroad passengers from that city should be examined as to their sanitary condition, and if they have been vaccinated. The Springfield, Mass., *Republican* is credited with the story of a Vermont woman who, having occasion to travel on a Montreal train, determined to outwit the sanitary inspector by making him think that she had been recently vaccinated. Accordingly, she sewed a button to the inner side of her sleeve, at the usual site of vaccination, and, when the inspector asked her to show her arm, answered that it was not necessary, for he could "feel the scab." The device is said to have succeeded.

MECHANICAL AIDS TO DECORATION.

By A. Curtis Bond.

Mechanism in decoration, by which color designs and forms may be indefinitely repeated or multiplied, is always in course of progress; yet it here would seem, with all the varieties of adaptations which we witness, certain defined limits, and in numberless directions of decorative art handiwork, well asserts its superiority. Yet mechanical production itself bears the stamp of intelligent purpose and constructive ingenuity, it being, so to speak, a transfer of handwork, an intermediary between the designing brain and hand, shown in the pattern and the execution. The die of the mould for molten metal and plastic material has either itself to be worked out by hand, or, if obtained by impress of relief work, the relief model has to be carved. The production and duplication of much decorative work by mechanical means is recommended by economy, in some instances by greater uniformity; but in the higher spheres of decoration, the absolute uniformity thus obtained falls far short in value of the direct work of the hand. This is evident in ornamenting in color, walls, and ceilings, if the execution be skillful, as compared with stenciling. The slight variations in the ornament—for the work of the hand never absolutely repeats itself—is itself a charm, as showing greater freedom of execution, and in some instances greater delicacy of touch. Nevertheless, decoration is greatly behooven to the mechanical arts for its diffusion, whether in furniture, structural surfaces, or the ornaments by which interiors are adorned.

One of the greatest novelties promised in mechanical devices, as concerns painting, is a machine consisting of a hand piece, a compressed air chamber, and an air pump, with communicating cup filled with liquid pigment, which enables the artist to throw out a spray which, in the first instance, forms a fine line, and in the second, widens the line to the desired breadth. The skill required in the operation, the proportions to be given to the line, renders the line, which may even be thus shaded at will, something more than mechanical work.

Many devices for facilitating decorative work may be characterized as assistive. They are brought in co-operatively, and are little more than the brush to the painter. The improvement in tools merits notice here. Take, for instance, the wedge-shaped brush so useful for many purposes, previously to the manufacture of which decorative artisans had to wait the wearing down on one side of their flat brushes. Fortunes have been made by smaller devices than these, suggested primarily by individual requirements, and really foreshadowed by the efforts of artificers in their practices or methods to devise means for escaping inconveniences attached to their tools. The tools used for wood carving, and adapted to special purposes and to different scales, have been greatly increased in number of late years. There are mechanical devices which may be regarded as completing the operations of the hand, as when, previously to applying veneer, the ornament adjusted to the pattern and already rubbed down with the veneering hammer, and affixed by glue to paper, is placed between hot boards and pressed with hand screws, which, when the glue is dry, allows the work to come out quite clear from the boards and appear as one piece of veneer, which is then ready for application.

The cowl with its screw clamps comes to the aid of the veneerer to secure a graduated pressure, commencing from the center of the pieces, being an exact counterpart of curved work, and, when flat, employed, like the veneering hammer, for plane surfaces. The heat of the cowl quickly penetrates the thin veneer, making the glue exceedingly fluid, and the pressure applied by the clamps soon expels the greater portion of it, and causes the veneer to bed very closely to the work. Wood carvers, in copying models, are now supplied with a marking or cutting gauge of ingenious construction, by which, when once set to the required dimensions, they can not only give all their markings the relative width, but secure depth of the ground line of the carving and height of relief portion, or rather the excess on their own panel, so as to enable them to cut away freely, instead of timorously dealing their strokes.

The services of the lathe are particularly prominent in decorative woodwork, particularly in hand-turning. In hand-turning the tool is held by the hand, the changes of form made in the wood being dependent on the relative position or angle of the cutting edge. It is the work of an instant only to vary the relative height and angle of a hand tool to the work, converting it from a roughing to a finishing tool, or even to a scraper, which operations are often impracticable with a tool held in a side rest. With the latter the guidance is solely by the eye; with the lathe the delicate sense of feeling is appealed to, so that any variations may be made with absolute accuracy.

In the development of electricity as a motor under the system of storage, much of the preparatory work of the moulder, whether in wood or metals, will doubtless be greatly aided in the future.

Scaffold brackets are among ingenious contributions to the satisfactory execution of exterior house decorative work on walls. This work is necessarily done much better when the artisan has not to balance himself, but obtains a steady platform without unpleasant swaying. The ladder is made with large hooks at top to hang from window sills, and the platform, which is transferable to any of the runs, is fastened by curved hooks attached to an environing bar both to that rung and the rung above.—*Cal. Arch.*

AN ENGLISH FARM HOUSE.

We give an elevation and plan, from *The Builder*, of a farm house lately erected in Sussex, England, at Vandeane. It presents some interesting suggestions to those who contemplate building in the cottage style.

AN ENGLISH FARM HOUSE.

EARTHENWARE AS A BUILDING MATERIAL.

There has been a decided tendency of late to take advantage of the large adaptability offered by terra cotta and other forms of earthenware in architectural applications. It will be remembered that many ancient cities, such as the great Babylon, for instance, were built almost entirely of brick and tiles, though the resources of the ancient potter were much more meager than at present. A larger use of these materials is now being advocated in England. At Brighton and Tunbridge Wells, bricks have been used for paving the street footways, and have proved quite satisfactory. It is considered an advantage that they afford a bit of color in the otherwise monotonous highways. While they are unsuitable for localities where they would be subjected to crushing or jarring under heavy carts and wagons, they are less worn away by the action of water than flagstones, and, being more porous, dry off sooner after a storm. They are cheap, and may be renewed rapidly without interfering with travel. Blue paving bricks are also being advocated for roadways. They are cleanly, and give a secure footing for horses. The cost is considerably below granite, and they would probably wear much better.

As a material for sewers and culverts, brickwork is excellent, and earthenware is admitted to be the best for drains. It is possible that gas and water mains will some time be made of the same material. The glazed surface of earthenware pipes renders them nonabsorbent, and, being non-corrosive, they offer no impediment to the passage of water or sewage. Cast iron pipes, it is well known, are liable to be gradually eaten away by the action of gases and acids. Earthenware, on this account, is much preferred for carrying off the wastes from laboratory sinks, since it is free from rust or corrosion. Could it be substituted in water pipes, the supply would be delivered in a purer state and without danger of metallic contamination. Its use in hot water or hot air pipes for heating purposes, and in stoves and furnaces, is considered much more wholesome than iron. Stoves of soapstone or fireclay give a more even heat, and do away with the unhealthy and disagreeable odors which are always noticed in the presence of overheated iron.

It is also suggested that rainwater pipes, instead of being the unsightly affairs they often are at present, might, if manufactured in colored faience, be made to form a pleasing feature in the ornamentation of a building. There are occasional sites, where stone can be quarried in the immediate vicinity and used as an economical building material, but as a rule brick is very much cheaper. A two-brick wall is as strong as one of solid masonry two feet thick. Six inches in space may thus be saved—a matter of some importance where land is very valuable. Bricks absorb more moisture than stone, but they retain it for less time, and there are effective methods of protecting brick walls from dampness, which would be less applicable to stone. Experience in the larger cities has shown that brick possesses a much higher resistance to the destructive influence of fire than any varieties of building stone. At Boston it will be remembered that the solid granite buildings cracked and crumbled in the intense heat before the flames reached them, while those of brick remained comparatively firm.

Another form of earthenware which is very effective artistically, and shares the other advantages of its class, is found in tiles. Hanging against a cheap foundation of ordinary brick, they form a most picturesque covering for external walls. If glazed, they will not absorb moisture. Roofing tiles afford excellent protection against changes of temperature. When chosen of a color to harmonize with the walls of the building, and arranged at a steep pitch on roof and gable, they are very effective. In combination with brick, terra cotta is also becoming deservedly popular as a most durable and artistic building material. As a coping to parapets it possesses many advantages over stone in being free from decay and less affected by the action of storms. In many of our most beautiful modern dwellings, the entire ornamentation is in terra cotta. This is particularly the case in Philadelphia, where the best quality of clay is found within the city limits. Bricks of rich tone, shaped and pressed, when laid in black cement and relieved by copings, dentils, and panels of terra cotta, form some of the most pleasing buildings of the city. But there are bricks *and* bricks. A bad material poorly baked will give wretched results, but, when properly made, there are few more agreeable or durable building materials. English bricks of the last century show a particular indestructibility. Many old Philadelphia residences and not a few Quaker meeting houses in the surrounding country, which were built before the days of the Continental Congress, are still standing and in an excellent state of preservation. Beyond a little wearing away of the mortar, they show no signs of deterioration, while they have already witnessed the rise and fall of several generations of less substantial structures.

MASONRY AND BRICKWORK IN FIRES.

In the whole range of building materials there is perhaps none so unsuited for resisting fire as that most commonly in use—stone. It is true that, if embedded in cement or in thoroughly good mortar of lime and sand, it will resist for a considerable time heat gradually applied; but even in such a case it will become calcined, and will crumble to so great an extent as to be unable to carry a load afterward. In the case of any sudden change of temperature, either from cold to heat or from heat to cold, it cracks instantly without notice, not only leaving a passage for smoke and flame, but in many instances causing the wall to fall. Stone may, however, be used with a certain amount of safety for external walls, but even for this purpose it is very much inferior to bricks. Bad mortar is frequently a cause of heavy loss; it has no adhesive power, and, consequently, fails to bind the other materials in such a way as to prevent buckling. A great quantity of the mortar used in this country during the last fifty years is but little better than road mud, which, though in itself well suited to resist fire, is wanting in the most essential qualities for combining with other materials. Really good mortar becomes in course of time as hard as the bricks or stones, and good cement becomes much harder. In fact, when a hole has to be cut in a wall of bricks laid in sound cement, it is generally necessary to cut through the bricks, as the tools in ordinary use for such purposes cannot cut through the cement.—*E. M. Shaw, in The Architect.*

A company for the manufacture of fireproof lumber is in process of organization at Chicago. The capital is to be $100,000. The desirableness of the object is evident at a glance. This scheme is a significant indication of the extent to which the importance and necessity of the prevention of fires is occupying thinking and inventive minds.

Lumber that can be rendered to a good degree fireproof, at a reasonable cost, would certainly be in great demand. We wish the Chicago enterprise much success.

STONE PILES IN WASHINGTON TERRITORY.

To the Editor of the Scientific American:

I see in the SCIENTIFIC AMERICAN of October 31, a notice of the "Stone Piles" of Washington Territory, wherein the writer expresses his belief that the mounds were the nests of some kind of aquatic creatures, and refers to an article on the "St. Lawrence Chub Nests" in support of his theory.

I am not acquainted with the locality, "Stone Pile Meadows," to which he refers; but I know something of Mound Prairie, Mima Prairie, and Rock Prairie, all in Thurston County, W. T., and presume that the mounds on those prairie meadows are of the same formation and origin as the ones he names.

I had heard the fish-nest theory advanced by Mr. Thomas Condon, formerly State Geologist, Oregon, and, until I visited Washington Territory, supposed his theory to be correct. But a very slight examination of the mounds upset that belief.

After listening to theories of all kinds, some of which might be called possible, but none of which appeared at all probable, I settled on the ice theory for myself.

In the first place, it must be understood that these prairies are the dry beds of what were once shallow lakes, made dry partly by filling up with wash from the surrounding hills and partly by the wearing away of some obstruction that dammed the water back. That these lakes were shallow is fully proved by the entire bottom being covered with well-washed gravel.

Now let us go back to the earlier ages of the world, to the time when the climate of the northwest coast was much colder than now; when the ice formed to the depth of several inches every winter.

Next we must imagine the end of summer, when, through a very porous soil below and a hot sun above, the bed of the lake was left completely dry. Of course, while the bed of a lake may be, generally speaking, level, yet there will be many little depressions and as many little hillocks, all barely visible above or below the general surface.

After summer come the fall rains; gradually the thirsty soil becomes saturated, and then little by little the water accumulates in the small depressions of the lake bed. Inch by inch the water rises until the whole surface is covered. Then the rains cease, and the frost sets in. One or two months of frost is sufficient; the water is frozen solid to the bottom, and probably several inches below. But spring approaches, the frost ceases, and the rain again comes down in torrents. The flood soon lifts the ice, still gripping its load of gravel, and it goes floating about in broken fragments, that from the deepest places being the thickest, carrying the biggest rocks and the most of them. But the floes cannot go far, because some little rise will catch one and hold it, and another little rise will catch another and hold it, and so on. Now, where each floe is caught and held, it will deposit its load of gravel and sand. So there we have two results—the hole, or depression, where the flow came from is deepened, and the hillock where it lodged is raised, or a new mound started where it was level before. The next year the process is repeated; the deepening places always giving up the most material, and the growing mounds always forcing its delivery as a new contribution to their growth.

How many years the process may have been going on would be hard to guess, perhaps for thousands, until the barriers that confined the water were finally worn away, and channels formed, growing deeper and deeper, until now the beds of the Chehalas and Black rivers are many feet below the present level of the former lake beds.

One strong proof of the ice theory is in the fact that some of the largest rocks, from five to ten pounds in weight, and perhaps larger, are often found at the top of the mounds.

These mounds are of all sizes, from mere swells, barely perceptible, to cones eight or ten feet high. In some places they stand so close together that their bases almost touch, while in other localities they are more sparsely scattered.

The material of which they are formed is the same as that over which they were raised—sand and gravel—ranging in size from the merest speck to ten and probably more pounds in weight. D. I. C.

Lafayette, Oregon, November 11, 1885.

TWO CHIMNEY-PIECES IN WOOD.

THESE fireplaces were designed by Mr. R. A. Briggs, A.R.I.B.A. The drawing-room mantel is for Mr. J. B. Knight of Kensington, and the other is for a dining-room. This latter is furnished with two glazed-fronted lockers or cupboards, while a broad cornice top provides a good shelf for the display of delft and china ware. The grate is a basket one, with a tile-lined fireplace and hearth. For the drawing-room, a hooded arrangement forms the basis of the design, with a hung looking-glass fixed in the center of the front face. On either side of this are two vase brackets with the motto "Loyal en tout" carved on the fascia, below which is hung a deep volume in richly embroidered stuff; a heraldic shield surmounts the glass frame, and the front of the wood is highly decorated in colors.

TWO CHIMNEY PIECES IN WOOD.

THE HUMMEL MONUMENT AT PRESSBURG.

ON the 14th of November, one hundred and seven years ago, the celebrated composer Johannus Nepomuk Hummel was born in Pressburg. He received his first instructions from his father, who was a thorough musician, and was appointed director of the orchestra at a theater in Vienna. At that time young Hummel was seven years of age, and created quite a sensation, attracting the attention of even Mozart, who was so delighted with the child that he took him to his own house to educate him. How often and with what regularity he received lessons from Mozart cannot be ascertained; but as Hummel had to play all the music for Mozart, there is no doubt that he was benefited greatly by being in the company of the great master.

He remained with Mozart until November, 1788, and then went on an artistic tour lasting six years. Upon his return he was highly recommended by Joseph Haydn, and accepted a position with Prince Esterhazy. In 1811, he returned to Vienna, and occupied himself in giving piano lessons until 1816, and in this year he accepted a position in Stuttgart, which he exchanged for one in Weimar, where he died suddenly, October 17, 1837.

He had acquired for himself a great and celebrated name, not only as a musician, but also as a composer; and at the present day Hummel's works are considered among the finest. As a performing artist he continued in the manner of Mozart, and combined a noble delivery with a brilliant technique, and is the founder of the modern school of virtuosi. He had great talent for improvising, and was no doubt one of the best composers of instrumental music in the nineteenth century.

In 1878, it was decided to raise sufficient money by means of concerts to erect a monument to Hummel at Pressburg. Franz Liszt, Hans von Bülow, Anton Rubinstein, Count Zichy, Joachim, the Meininger Orchestra, Saint Saens, D'Albert, Hummel's great scholar Ferdinand Hiller, and many others contributed to make these concerts a success.

The designs for the monument were prepared by Prof. Victor Tilgner of Pressburg, and the committee made arrangements with him for the execution of his work. A short time ago he delivered his first model, which is represented in the annexed cut, taken from the *Illustrirte Zeitung*. The monument will probably be completed next summer.

This design consists of a Hermes column, the upper part of which is formed by a bust of Hummel, from which wreaths are suspended. On the base a cherub reposes, reading notes from the sheet of music in his hand. Another cherub, at the side of the column, is represented as calling the attention of the first to the bust of the composer. A lyre ornamented with laurel rests against the other side of the column. The bust will be cast in bronze, double life size and the wreaths will be made of copper, fire-gilt. The column, cherubs, base, etc., will be of the finest Carrara marble. The cherubs form a charming group, which is highly creditable to Prof. Tilgner.

MONUMENT TO THE COMPOSER, HUMMEL.

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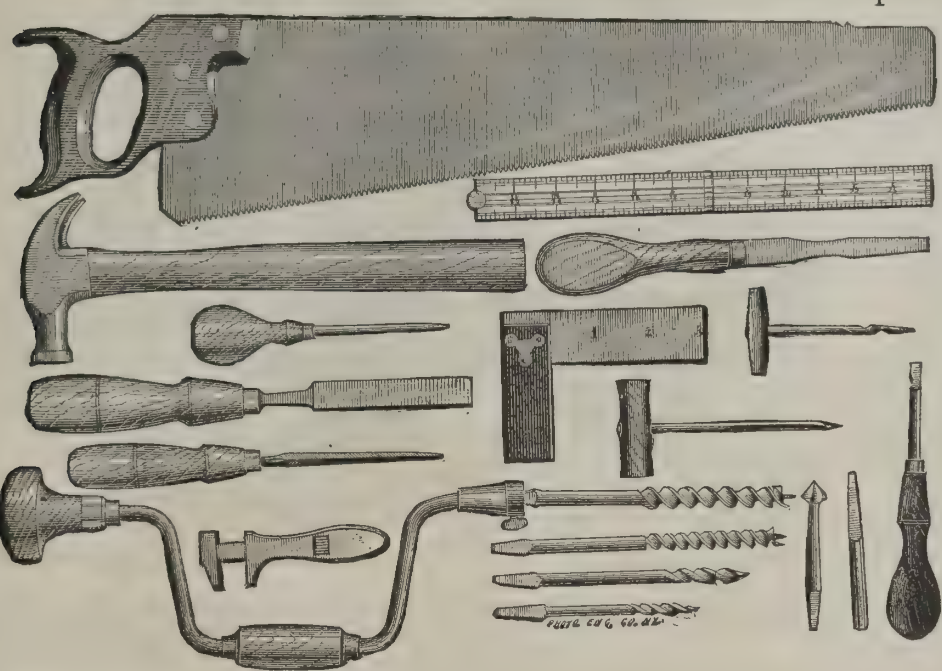

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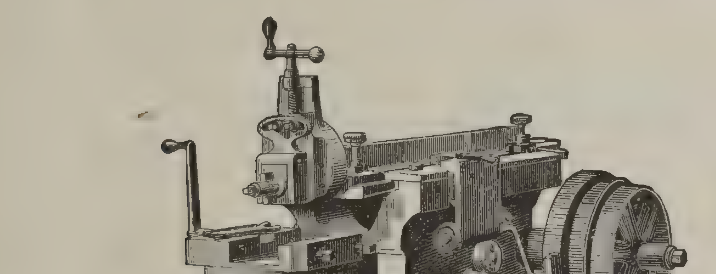

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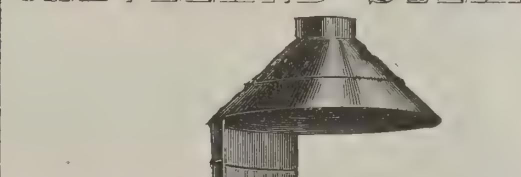

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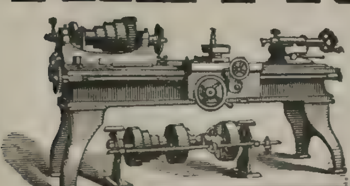

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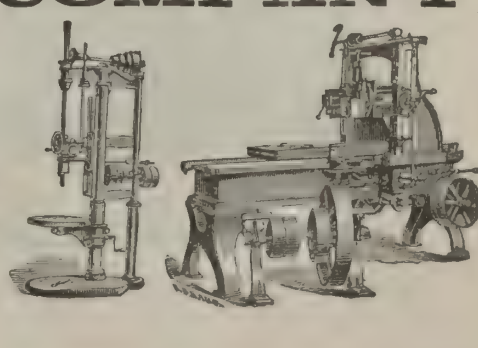

COTTAGES, ASKHAM, YORK.

THESE houses have been built by Sir Andrew Fairbairn, M.P., whose country seat is at Askham.

The aim of the architects, Messrs. Chorley and Connon, Leeds, has been to design cottages that would picturesquely blend with the woodland scenery amid which they are placed; and in this they have been materially assisted by Sir Andrew Fairbairn, who has looked rather to the comfort of his tenants than to considerations of economy.

The buildings are of red brick, tile roofed, and the woodwork finished in harmonious colors.—*Building and Engineering Times.*

THE NEW FEDERAL BUILDING, BROOKLYN, NEW YORK.

THIS structure, as our readers can judge from the illustration, will be "a thing of beauty," something indeed worthy of Brooklyn.

While Mr. M. E. Bell, the architect of the Treasury Department, provides an exterior that will appear as a monument of his skill, the internal conveniences will doubtless prove to be all that judgment and good taste could suggest.

Over sixteen years ago it was generally conceded that such a building was an absolute necessity, and the matter was vigorously agitated, but it was not until the Congress of 1883 that the united efforts of the Hon. J. Hyatt Smith, Hon. A. M. Bliss, and the Hon. Wm. E. Robinson secured the first appropriation of $300,000, an amount quite inadequate, of course, but something substantial at least to start with. This amount was subsequently increased to $500,000.

After many delays and disappointments with regard to a suitable site, Secretary Folger, on February 16, 1884, gave Mr. Leonard Moody permission to purchase on Washington, Adams, and Johnson Streets a plot 175x235, for $408,500. The task was not an easy one, for the reason that selfish interests clashed with those of the government, and much valuable time and some money was wasted in foolish contestation.

The site finally selected is probably as eligible a one as could be found, and with the possible widening of Washington Street, the structure will have a prominence worthy of its architectural grace. It is purely renaissant in the style of its architecture. The tower will be at the corner of Washington and Johnson Streets, and it will have a frontage of 135 feet, a high basement, and Mansard roof.

The main cornice will be 75 feet from the pavement, and the tower will be 183 feet high.

It is believed that the Johnson Street front will be 235 feet. The post-office will occupy the basement and first story.—*Brooklyn Advance.*

THE NEW POST OFFICE, BROOKLYN, N. Y.

USEFUL DIRECTIONS FOR TAKING PORTRAITS INDOORS WITHOUT A SKYLIGHT.

By L. P. FERRIS.

To those amateurs not possessed of a skylight, the question of how to obtain a good indoor portrait is very puzzling, and has led to the spoiling of a great many plates and to the production of some hideous-looking faces, struck by lightning on one side and by midnight on the other. I propose in this article to give such directions as will enable any one who is skillful in outdoor photography to make a better portrait in an ordinary room than can be made in the open air. In fact, there is no reason why as perfect a portrait cannot be made in an ordinary room as in a "gallery," except the lack of skill on the part of the operator.

TO MAKE A BUST, CABINET OR HALF LENGTH.—LIGHT.

The first attempt is generally made in the room having the largest number of windows, all of which are opened to their fullest capacity, which only results in complete failure. The room preferable is one on the second floor or higher, and on the light side of the house. Close the blinds or lower the shades in such a way as to exclude the light from all windows but one. This window should be selected in such part of the room as will allow working space on both sides of it. A corner window with the side wall close to it is objectionable, for the reason that a background would be so near to the sitter that a shadow of the figure would be made upon it. Now, having the window open and the shade rolled all the way up, if there is sunlight or even a strong light upon it, darken the lower half by unhanging the shade (if convenient) and placing the roller upon the top of the lower sash. Allow the shade to fall to the sill, or hang anything over the lower sash that will exclude the light. If the subject is of very dark complexion, a piece of muslin would answer better than something opaque, as it would diffuse light over the face in addition to that obtained from above. If the clothing or drapery is very dark, it is well to obstruct the light from the lower sash just opposite the face and let it pass through below, so as to light up from the neck down; this will insure detail in the drapery. Never allow sunlight to fall upon any part of the sitter.

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An increase of nearly two million dollars in income, over three millions in surplus, over seven millions in assets, and of over thirty millions of insurance in force, during 1885.

SUMMARY of REPORT. BUSINESS of 1885.

Received in Premiums	$12,722,103.03
Received in Interest, Rents, etc.	3,399,069.71
Total Income	**$16 121,172.74**
Paid Death-claims	$2,999,109.64
" Endowments	741,764.47
" Annuities, Dividends, and for Policies purchased	3,940,999.64
Total Paid Policy-holders	**$7,681,873.75**
New Policies Issued	18,566
New Insurance Written	$68,521,452.00

CONDITION JAN. 1, 1886.

Cash Assets	**$66,864,321.32**
*Divisible Surplus, Co.'s Standard	$7,064,473.13
†Tontine " " "	3,123,742.77
Total Surplus, " "	**$10,188,215.90**
Surplus by State Standard,	**$13,225,053.94**
Policies in Force	86,418
Insurance in force	$259,674,500.00

PROGRESS IN 1885.

Excess of Interest over Death-losses,	$399,960.07
Increase in Income	1,880,697.35
Increase in Surplus, State Standard,	3,313,707.48
Increase in Assets	7,580,567.75
Increase in Insurance Written	7,036,902.00
Increase in Insurance in Force	30,291,914.00

* Exclusive of the amount specially reserved as a contingent liability to Tontine Dividend Fund.

† Over and above a 4 per cent. reserve on existing policies of that class.

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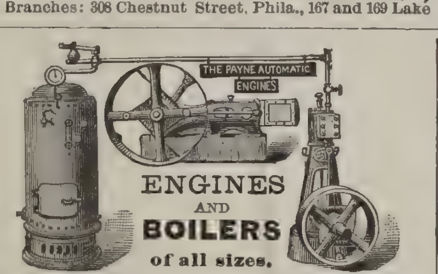

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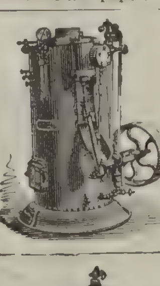

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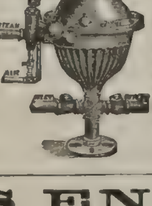

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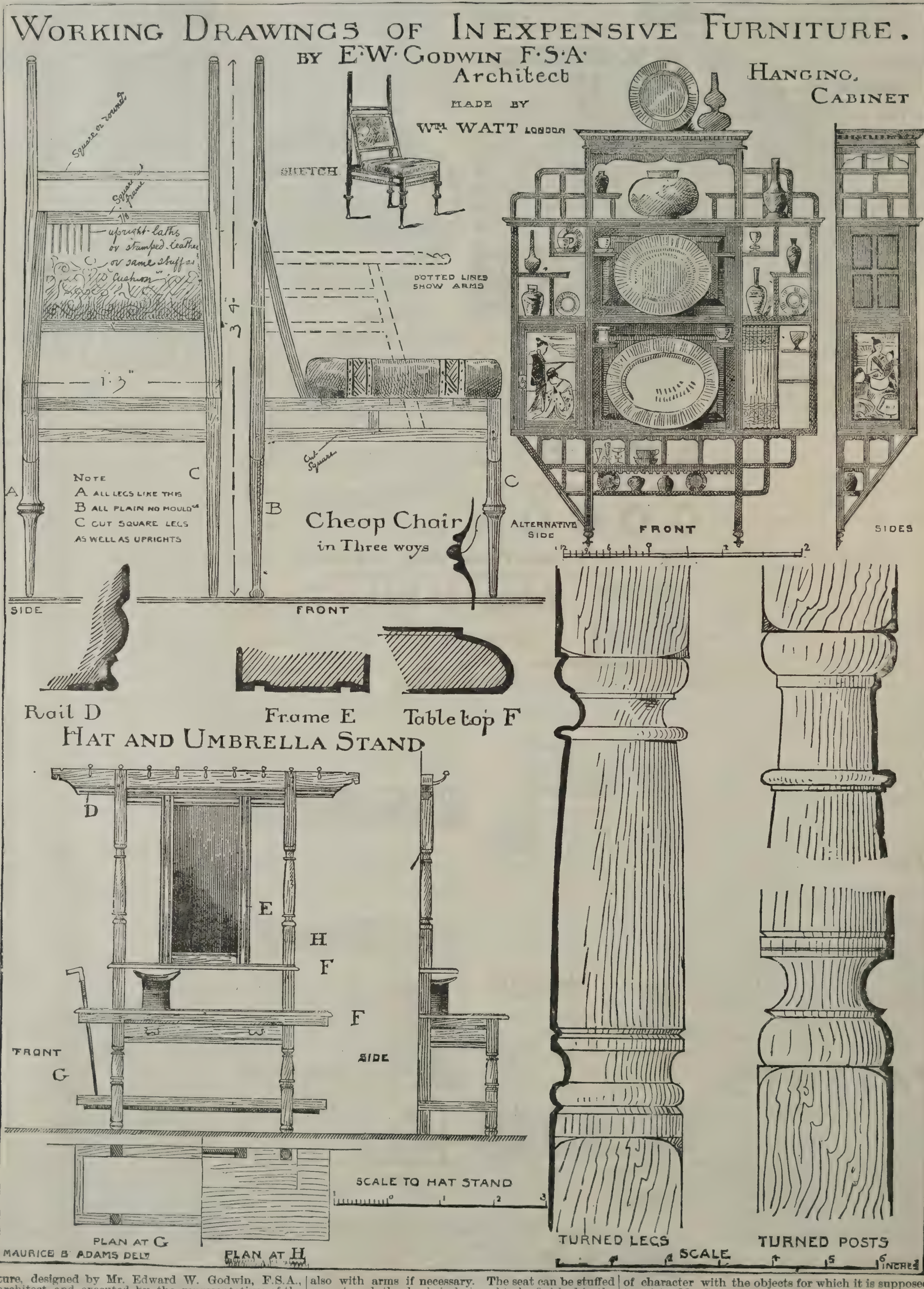
WORKING DRAWINGS OF INEXPENSIVE FURNITURE.

By E. W. Godwin, F.S.A.

This sheet of details furnishes the working drawings to scale of three useful and inexpensive pieces of furniture, designed by Mr. Edward W. Godwin, F.S.A., architect, and executed by the representatives of the late Mr. Wm. Watt, of Grafton street, W. C. Economic furniture, which also has the merit of being artistic, suitable, and useful, thereby being really adapted to the everyday requirements of ordinary people, must necessarily be always in demand, and therefore illustrations such as these, which we include in our number of plates to-day, certainly will be welcomed by many of our readers, especially those who know Mr. Godwin's designs, and have seen them beautifully carried out by Mr. Watt. The "cheap chair" details show how the same design may be made in three different ways, and also with arms if necessary. The seat can be stuffed or not, and the back is designed to be finished in the same material as the seat, or with upright laths, as may be wished to suit circumstances. The hanging cabinet is well adapted to the suitable display of works of art and ceramic ware, and is made in ebonized wood with panels fitted with Japanese designs, the whole being conceived somewhat in that manner or style of wood treatment.

The hat and umbrella stand is, of course, a very useful piece of furniture in most houses, and yet, generally speaking, it is one of the most ugly and inconvenient articles conceivable, vulgar in taste, and quite out of character with the objects for which it is supposed to exist. Mr. Godwin's design has nothing pretentious about it; on the contrary, it is as simple as can well be thought of, and yet how well it answers its purpose without being too big, and it has the merit of being simply what it was intended to be.—*Building News.*



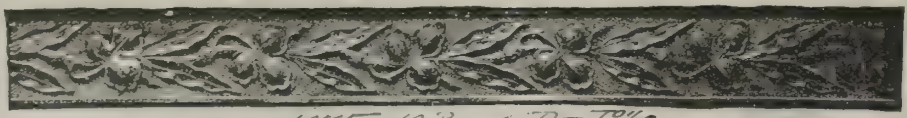
NEW DESIGNS FOR LINCRUSTA WALTON.

We present on this page illustrations of some of the most recent designs of lincrusta walton which have not heretofore been published.

This material is now too well known to need any special description, but we may remind our readers that, starting with a plain hard finished wall and a few plain pine mouldings, a most beautiful decoration can be achieved at a very moderate cost; borders are to be had from ½ inch upward, and as the designs are all in relief, all the effects of carved wood moulding and wainscoting are secured. All forms of woodwork, such as doors, shutters, mop board, etc., can be treated in the same way. Elegant effects can be secured also in thus decorating woodwork in the fittings of stores. Architects, builders, and others who desire to use this material should secure the full book of designs published by F. Beck & Co., New York.

No greater proof can be offered that lincrusta fulfills every merit claimed for it as a perfect wall decoration and covering than the unqualified approval of those who have used it. It now adorns the walls in thousands of homes in every State in the Union, with perfect satisfaction in every instance; and it is placed on official record that at the State Capitol, at Albany, it proved a splendid success, when paper, leather, and every other form of mural decoration had failed.

In respect to the sanitary properties of lincrusta walton, there can be no question, as it received, after the most crucial tests, the gold medal from the International Health Exhibition, London, 1884.



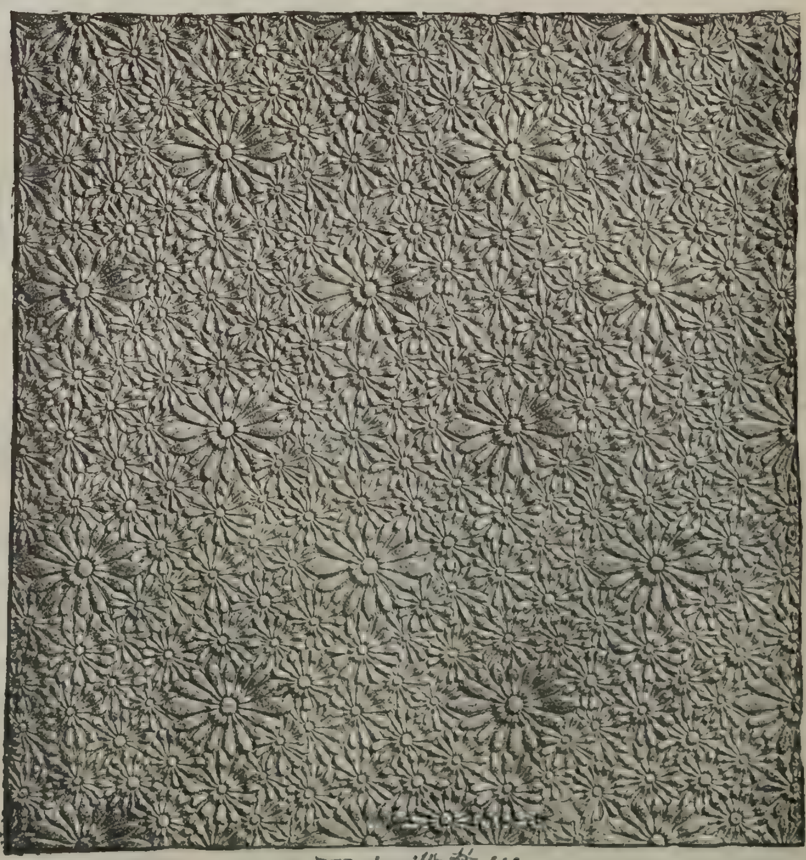
1075 10 Band RED T° 1/4

1076 - 10 Band RED T° 1/4

1077' 2 Band RED T° 1/4

RED T° 1/4 1070

RED T° 1/4 1071



RED to 1/4 # 111

The Latest Product of Wood Distillation.

It is reported in the *Echo Forestier* that a new industry, known as "wood oil distillation," has been established with much success in Sweden. The chief product made at the factories in question (which number upward of thirty in Sweden alone) is, in fact, the so-called "fir tree oil." somewhat largely used of late in the United Kingdom for its reputed antiseptic properties. The raw material drawn upon by the factories consists of the roots of the pine and larch trees which are left in the ground after the forests have been cleared for cutting up into deals, etc. This material is distilled in closed retorts, according to the ordinary way of carbonization; the products of the operation, besides the fir tree oil, being a notable quantity of terebene, creosote, tar, acetic acid, and charcoal.

It is somewhat remarkable that, although the destructive distillation of wood has been an established industry for a great number of years, this comparatively new product should now be elevated into the chief place among its fruits. Fir tree oil is capable of use for illuminating purposes, but not in the lamps ordinarily used for the lighter oils. It contains much carbon; and, there fore, burns with a smoky flame, unless the combustion is regulated under special conditions.

It may easily be mixed with common lamp oils, in proportions which will not prevent the burning of the mixture in ordinary lamps. In its natural state this wood oil is a very cheap illuminant, selling at 11 cents per quart. At this price it appears to compare unfavorably with mineral oils. But it is claimed for the wood product that it is absolutely inexplosible, which enables it to take the place of colza oil for dangerous places; also that in burning it lasts, weight for weight, 3·5 times longer than mineral oil. It is said the factories already established in Sweden produce about 10,000 gallons of fir tree oil per day.

The Sugar Crop.

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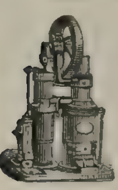

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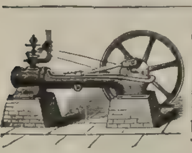

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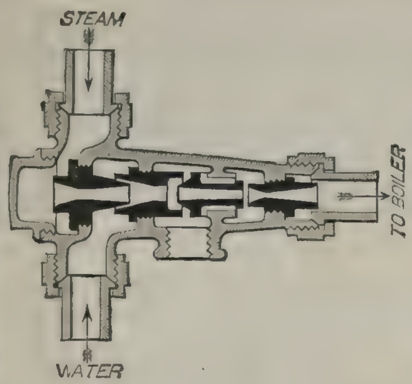

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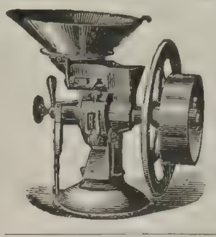

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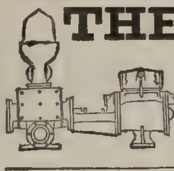

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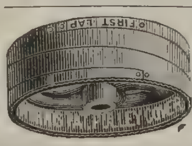

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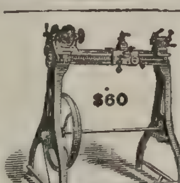

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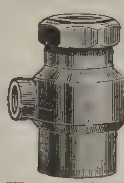

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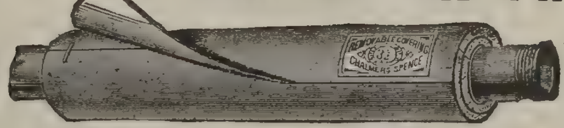

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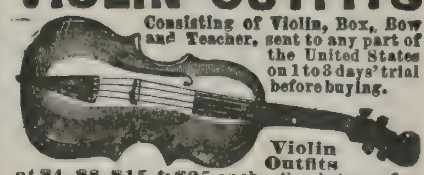

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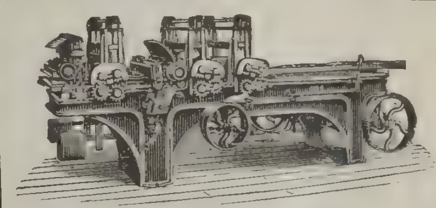

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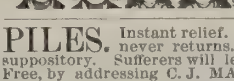

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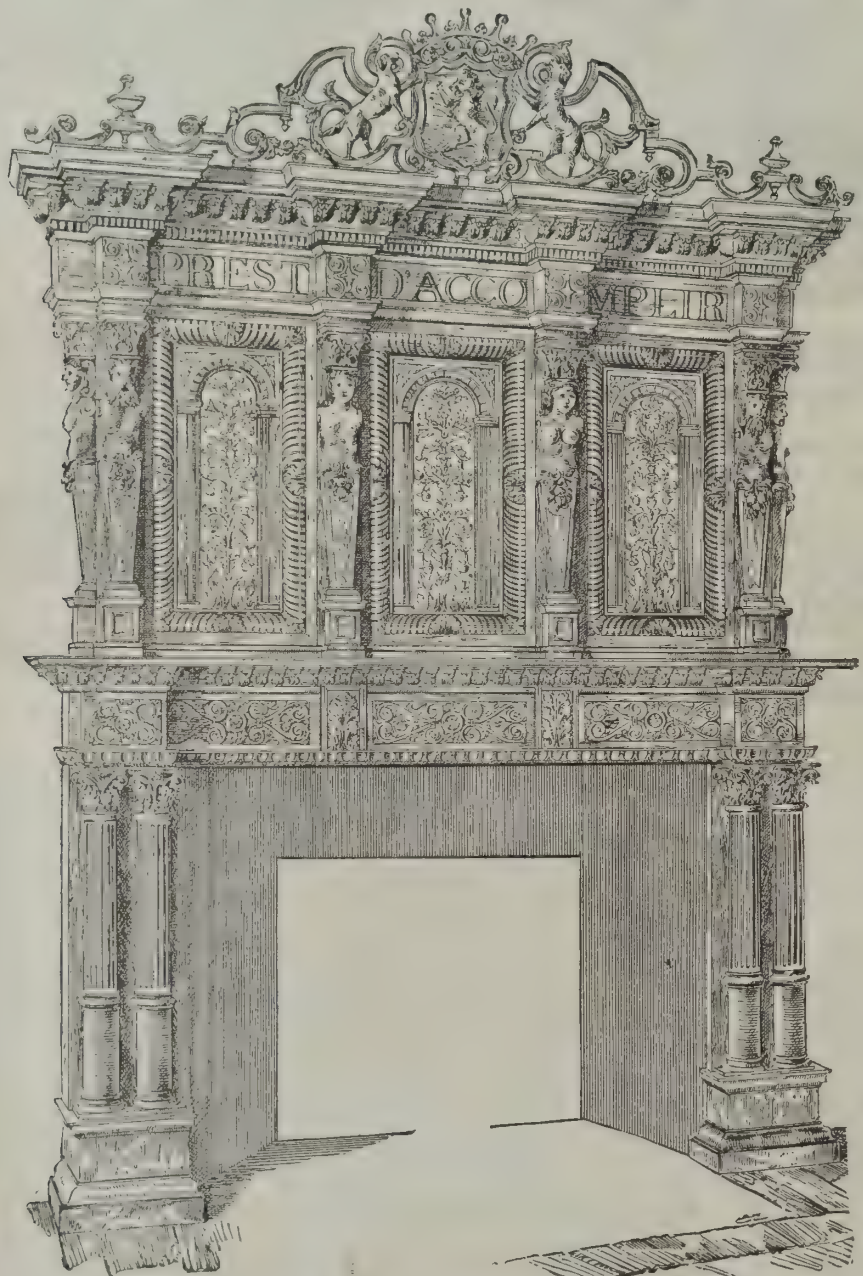
THIS is a characteristic piece of fifteenth century workmanship. The upper part, supporting the pulley, is entirely of wrought iron, the carved supports or brackets being brought over to a central pendant, and each of these is carried on a projecting little piece of metal, giving a sort of shoulder on the uprights above, which are two bolts firmly holding the parts together. The lower part of the structure is of stone, simply treated, with a curiously shaped projecting piece on the left-hand side of the capping ring of masonry; round this notched bracket the rope is fastened when not in use.

For the above and the illustration of the oak mantel piece we are indebted to *The Building News.*

OAK FIREPLACE AND MANTEL.

THIS example of an oak mantelpiece has been designed for the Earl of Shrewsbury by Mr. J. Birch, John Street, Adelphi. The whole is of oak, and above the mantel, which is divided into three panels, are caryatides. The panels between these are most elaborately carved with conventional foliage. The whole is surmounted by a characteristic cresting, in the center of which is the coat of arms and coronet, and below, on the frieze, the motto of the Earl of Shrewsbury (Prest d'accomplir), which, by the way, is badly divided, as only a portion of it comes in each panel. The mantel is supported on small brackets. Below this again, on each side, are two columns with Corinthian capitals. In the frieze which breaks round these is introduced the initial letter "S," in ornamental work, and the frieze has strap work, also ornamented with foliage. The whole is well and sharply carved, the modeling in the ornamental work being very good. It has been executed by the School of Art Woodcarving, who, we may mention, have some double doors and cresting for numerous bookcases for the library, in which this mantel is to be placed.



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THE COLORING MATTER OF WINE AND VEGETABLE COLORING MATTERS.*

By M. TERREIL.

THE coloring matter of wine and the red coloring matters of plants are precipitated from their solutions under the influence of an excess of hydrochloric acid. The precipitation takes place even in the cold, but slowly, twenty-four to forty-eight hours being required for its completion, while at the temperature of boiling it takes place in a few minutes.

The coloring matter is always precipitated mixed with an insoluble ulmic matter, resulting from the action of the hydrochloric acid upon saccharine substances that occur in the juice of the plant. But the two substances can be easily separated by means of alcohol, which dissolves the coloring matter and leaves the ulmic matter undissolved.

In isolating the coloring matter by this method there is added to the juice or colored liquid its own volume of strong hydrochloric acid; the mixture is then heated to boiling, and kept at that temperature for about ten minutes. The precipitate that forms is thrown on a filter, washed with distilled water until the washings are no longer acid, and then left to dry. When the precipitate is dry, it is treated with 90° alcohol, which dissolves the coloring principle. The alcoholic solution is evaporated to dryness at a gentle heat in the presence of a small quantity of barium carbonate, intended to saturate any trace of hydrochloric acid that may be retained by the substance. The dry residue is afterward treated with hot water, which dissolves any barium chloride that may be formed; it is then again dried, and the coloring matter is redissolved in alcohol. This second alcoholic solution, when evaporated to dryness, leaves the coloring matter in a state of purity under the form of a red-brown varnish, which detaches readily from the capsule in small shining scales. The author has never seen it present any indications of crystallization.

Hydrochloric acid does not precipitate the whole of the coloring matter, it being slightly soluble in acids.

The coloring matter thus obtained is entirely insoluble in water; but it dissolves very freely in alcohol, to which it imparts a yellowish red-brown color. Acids change this to an intense red color; but alkalies turn it green, and it then passes rapidly to yellow-brown through absorption of oxygen from the air. Alkaline solutions, even when dilute, dissolve the coloring matter immediately, the solutions, which are at first greenish, passing rapidly to brown. Ether does not dissolve a trace of the coloring matter.

The red coloring matters contained in various wines, in the skins of black grapes and black or violet plums, in elderberries, gooseberries, raspberries and mulberries, in the petals of poppies, mallows, hollyhocks, and roses de Provins, etc., all present the same character after having been precipitated by hydrochloric acid; they dissolve in alkalies, the solutions being of a green color and turning brown rapidly by absorbing oxygen from the air.

The red coloring matters of the fruit of *Phytolacca decandra* and beet are not precipitated under the influence of hydrochloric acid. Under the action of boiling hydrochloric acid these red matters at first become brighter, then violet, and finally pass to yellow-brown without yielding any precipitate.

The red of Campeachy wood, red woods, and archil is precipitated by hydrochloric acid. The precipitate is rather soluble in boiling water. It presents the distinctive character of dissolving in dilute alkalies with a violet color, the solutions turning brown in contact with air.

Litmus gives with hydrochloric acid a not very abundant precipitate, an alcoholic solution of which is reddish. The precipitate dissolved in alkalies gives a fine blue solution which remains unaltered when exposed to air.

It would appear from the foregoing facts that there exist in plants several red coloring principles, which may be distinguished from one another by the following characters;

1. The red coloring matters that are precipitated under the influence of hydrochloric acid, and are soluble in alkalies, which color them *green.* This is the most numerous class.

2. The red coloring matters that are precipitated by hydrochloric acid, and are soluble in alkalies, which color them *violet.* In this class are to be found the reds of dye-woods and archil, as well as of cochineal.

3. The red coloring matters that are precipitated by hydrochloric acid and are soluble in alkalies, which color them *blue.* Litmus is, hitherto, the only substance that presents this character; there are, however, certain red or rose colored flowers, the colored juice of which becomes blue under the influence of ammonia.

4. The red coloring matters that hydrochloric acid alters without precipitating them, such as the red of *Phytolacca* and that of the beet.

In order to recognize quickly the nature of the red coloring matter contained in any vegetable substance, the author crushes the substance between leaves of unsized paper, so as to cause the colored juice to stain the paper, and then exposes it to ammonia vapor, under the influence of which the color is changed to green, violet, or blue. Operating in this way he has ascertained the changes in color that the juices of the following plants undergo when exposed to ammoniacal vapor:

Rose..................	changes to	bright green.
Cherry laurel..........	"	bright yellow green.
Dark violet Marguerite	"	dark green.
Fuchsia, violet petals..	"	green.
" sepals........	"	azure blue.
Geranium............	"	blue with greenish tinge.
Pomegranate flower....	"	violet-blue.

WELL IN THE COURTYARD OF THE HOTEL DE CLUNY, PARIS.

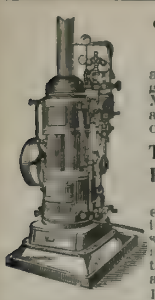
In examining the coloring matter of wine, the author heats about 5 c. c. so as to drive off the alcohol, then adds an equal volume of hydrochloric acid, and boils the mixture. After two or three minutes' boiling the liquid is thrown upon a small filter, and the red-brown precipitate produced is washed with distilled water; the filter is then crushed between unsized paper, and afterward opened out and exposed, still moist, above a flask containing ammonia. If the matter on the filter turns green, it is assumed that the coloring matter has been derived from the grape, or from a vegetable substance containing the same coloring principle as the grape; but at present it is impossible to say with certainty what substance has yielded the color.

Submitted to elementary analysis, the coloring matters of wine and of Campeachy wood precipitated by hydrochloric acid, and the ulmic matter precipitated at the same time as the coloring principles, have presented nearly the same centesimal composition, as will be seen from the following figures:

	Coloring of wine.	Coloring of Campeachy.	Ulmic matter.
C....................	55·63	56·27	56·70
H....................	5·50	4·68	4·73
O....................	38·37	39·05	38·57

THE THREE SOURCES OF PROSPERITY.—"There are three things which make a nation great and prosperous—a fertile soil, busy workshops, and easy conveyance of men and things from place to place."—*Lord Bacon.*

* *L'Union Pharmaceutique* for August, from the *Bulletin de la Societe Chimique.—Pharmaceutical Journal.*



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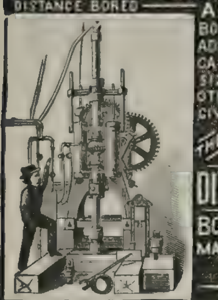

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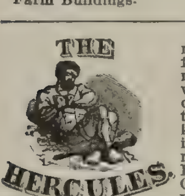

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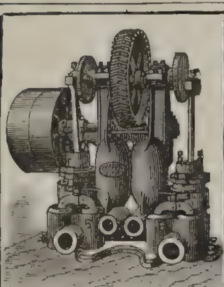

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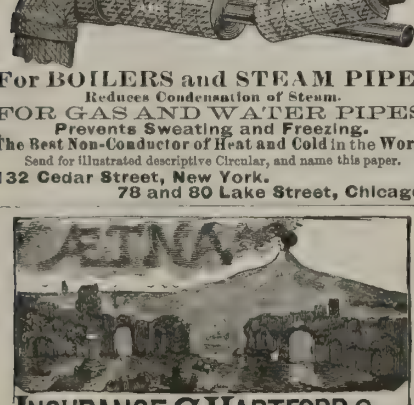

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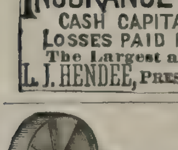

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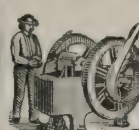

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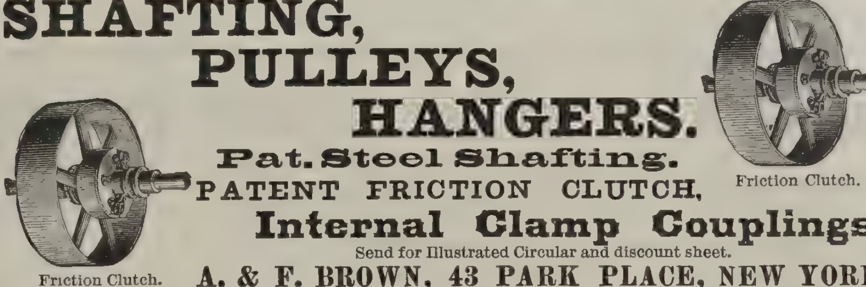

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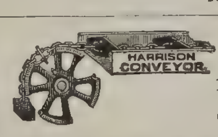

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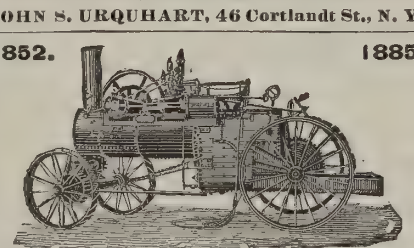

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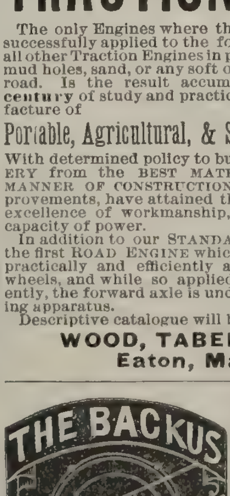

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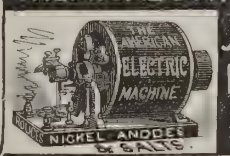

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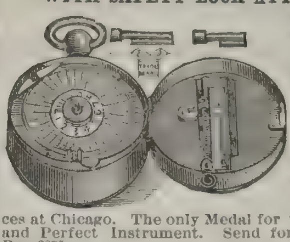

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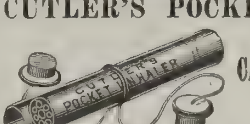

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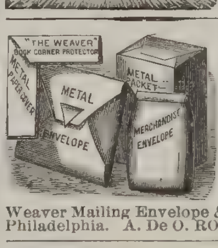

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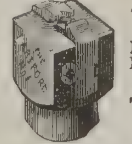

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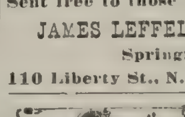

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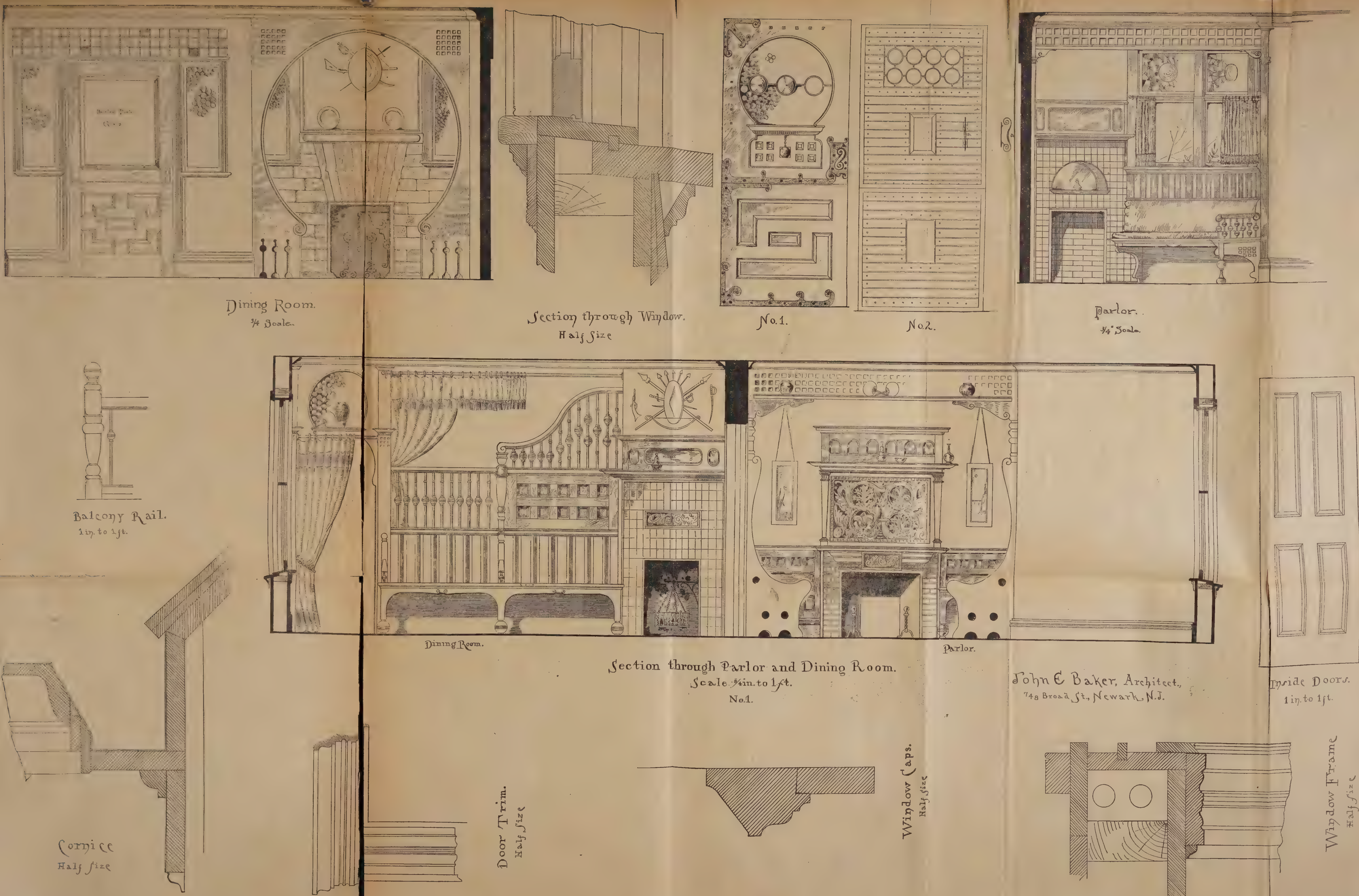

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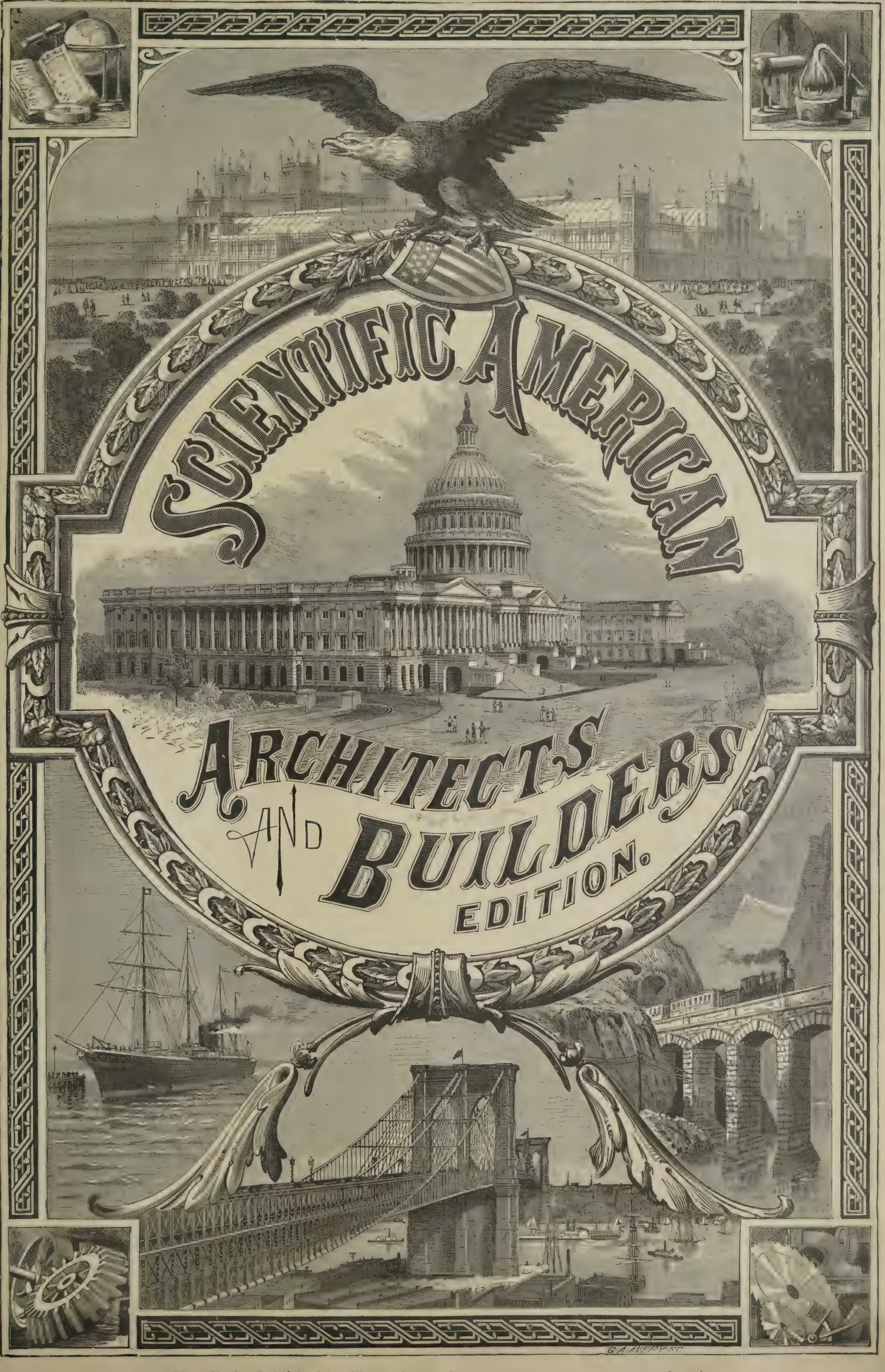

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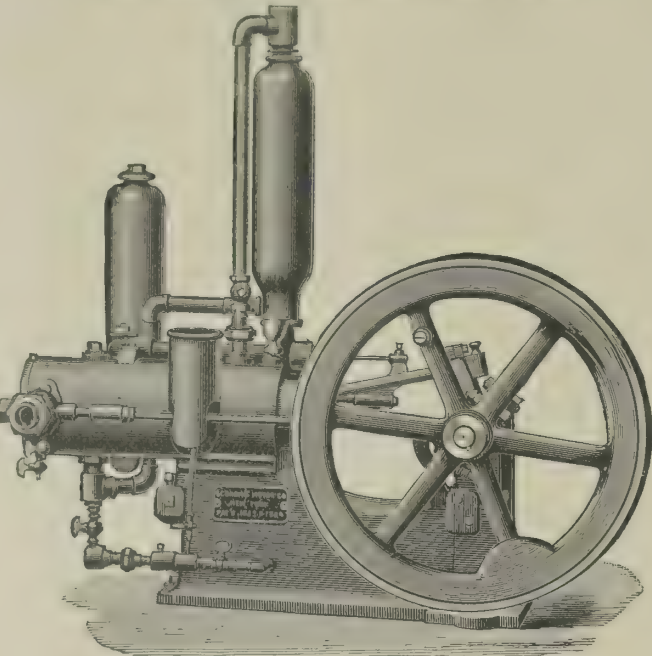

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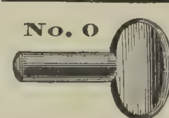

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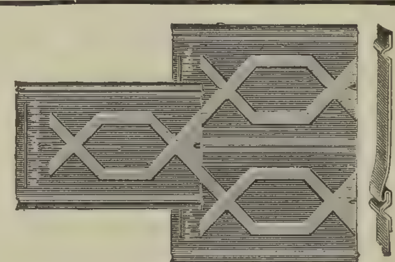

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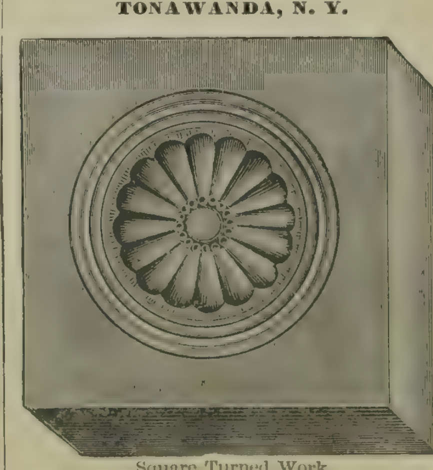

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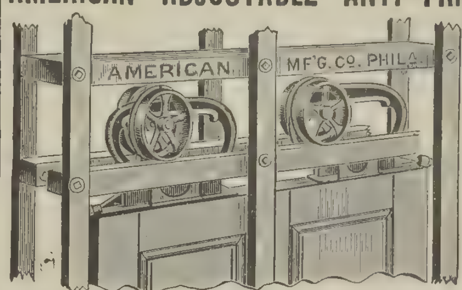

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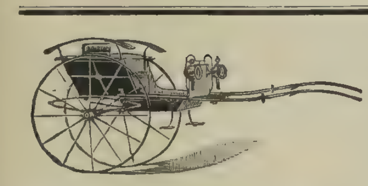

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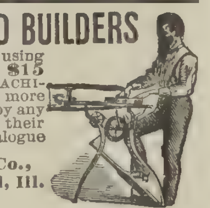

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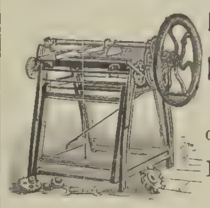

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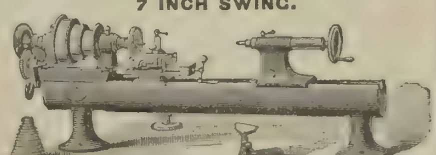

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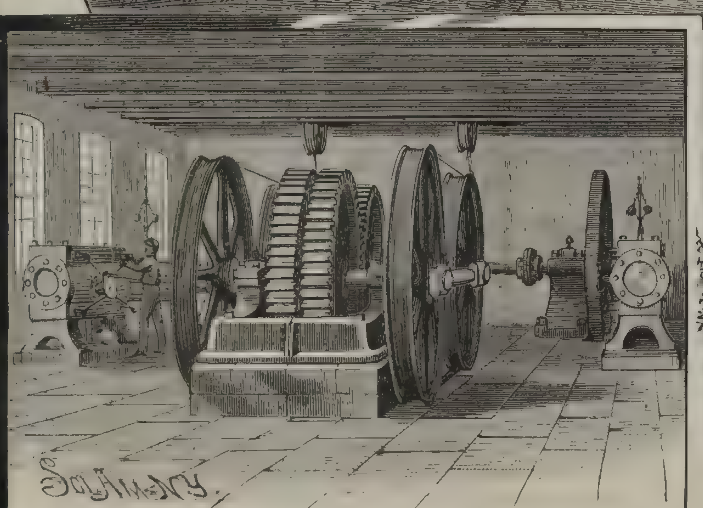
Vol. I. Subscription, $1.50 a Year. NEW YORK, APRIL, 1886. Single Copies, 15 Cents. No. 6.

THE HOBOKEN INCLINED CABLE RAILWAY.

The southern end of the Palisades, with its steep and rugged sides, has always presented a formidable obstacle in the path of the horse car railroads of Jersey City and Hoboken. Steam railroads overcame the difficulty by tunneling and open cuts, their main object being to pass the hill; but the horse cars, having to mount the hill to accommodate residents upon the Heights, were of course compelled to resort to other means. Twenty years ago dummy engines were tried on the routes leading from Hoboken ferry, but the grades proved to be too steep, and they were abandoned. Horses, four to a car, were again employed, and it took twenty minutes to reach the top of the hill from the ferry, a distance of only one mile. In 1873, the North Hudson County Railway Company concluded to construct a short but steep inclined plane, and to elevate both cars and horses by stationary steam power. A car and horses arriving at the foot of the hill passed on to a large and substantial truck and were drawn up the incline, 400 feet long and 100 hundred feet high, in one minute.

THE HOBOKEN INCLINED CABLE RAILWAY.



2

This was the first horse car elevator either in this country or Europe. It has been in continuous operation ever since completion, and has never failed to work or caused an accident.

The truck, or elevator platform, is triangular in shape; the hypotenuse is provided with four sets of wheels, which run up a track extending up the incline. When at rest, the horizontal side of the truck is on a level with the main track, either at the bottom or top of the hill, and is of sufficient length to receive a car and horses. There are two of these trucks, one upon each track. Two wire ropes lead from each car around drums operated by engines at the top of the hill. The cables are so arranged that one truck passes up while the other is going down. A third cable, attached to each truck and passing around sheaves at the top of the hill, serves as a safeguard in case either set of hoisting cables should break.

The travel increased to such an extent as to make necessary the providing of additional facilities for mounting the hill. It was therefore concluded to build the elevated railroad shown in our frontispiece. This easily accommodates all the travel, and also shortens the time to the top of the hill from ten minutes to five.

The most difficult task was to secure proper foundations for the posts. Soundings made between the ferry and hill showed the solid bottom to be from 20 to 90 feet below the meadow. At no point could a firm foundation be secured without piling. The higher part of the structure rests on towers 50 feet wide at the base and 22 feet wide at the top. Each of the four corner posts is set in heavy castings which rest on bluestone and brick piers 10 feet square at the bottom and 4 feet square at the top; these piers are built upon cross timbers which hold together clusters of 16 or 20 heavy piles. The foundations for the ordinary posts on the level part of the structure are of a similar character, but not so heavy. The structure is entirely of iron. The tracks are of 67 pound steel rails, not laid on wooden cross ties, but on white oak

THE HOBOKEN INCLINED CABLE RAILWAY.

blocks, which are bolted to iron plates riveted in between two iron channel bars, which, while adding strength to the structure, also act as guard rails. This mode of laying the track, dispensing with the wooden ties and substituting iron for wooden guard rails, is far preferable to that of the elevated roads of this city, as it is more durable, admits more light and air, and looks better.

The structure starts from the ferry at an elevation of about 8 feet, and gradually rises until it reaches the first street, where it is 15 feet high. It then continues level for about 3,500 feet, when it begins to rise at the rate of 5 feet in the hundred. There are two curves in the road, one at the ferry and the other at the foot of the steep grade.

The cable is of steel, 1½ inches in diameter, and the total length is about 2½ miles. The motive power is situated on top of the hill. There are four return-flue steel boilers, each of 125 horse power. There are two Corliss engines, having cylinders 30 inches in diameter and 5 feet stroke. The main shaft is 15 inches thick. The engines are so arranged that they can be used either singly or together. The flywheels are 20¾ feet in diameter, and each weighs 28 tons. The gearing for driving the cable drums—shown in Fig. 2—is similar to that illustrated in our article describing the Tenth Avenue Cable Railway, of this city, in the SCIENTIFIC AMERICAN of January 30, 1886, and was built by Messrs. Poole & Hunt, of Baltimore.

The arrangement and construction of the grips and rope lifters, Fig. 4, present many advantages over the old methods. The grips are not fastened to the body of the car, but to the wheel trucks, enabling the car to pass easily around the curves, and causing the grip to remain at the same distance from the cable, whether the car is loaded or not. There is one grip on each of the two trucks of the car. The grips are of iron, 3 feet long, and the cable is in contact with the jaws of the grip for the entire 3 feet. The grip is opened and closed by the turning of a hand wheel on the platform. A worm gear and set of levers, forming a powerful and positive movement, transmit the motion of the hand wheel to the jaws of the grip. In front and in the rear of each grip are two claws which can be opened and closed, lowered and raised, by means of a lever on the platform to the left of the grip wheel, and which enables the grip man to pick up the rope without the aid of any other person, and at any place on the road, level or inclined, at or between stations.

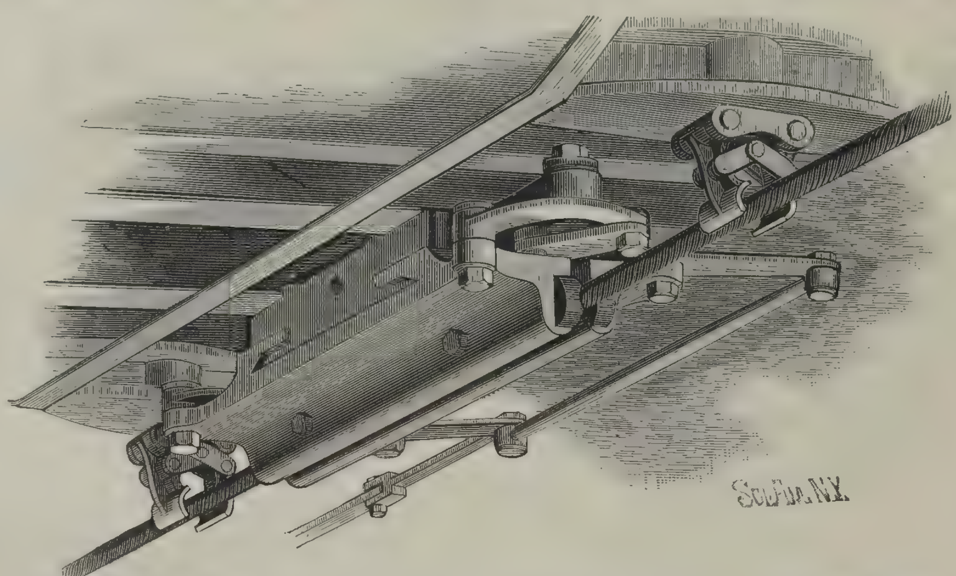


Fig. 4.—HOBOKEN CABLE RAILWAY.—THE GRIP AND ROPE LIFTERS.

The cars have the ordinary brakes to check the wheels. These brakes are tightened and loosened by the same wheel and worm gear which tightens and loosens the grip. A movement of a lever to the right of the hand wheel throws the brake into gear, and at the same time the grip out of gear, and *vice versa*, making it impossible to have the two forces (grip and brake power) operating against one another. In addition to the ordinary brakes, there are so-called track brakes, to be used in case of emergency on the incline and when the rails are slippery. Their shoes are about 2 feet long, are surfaced with wood, and can be pressed down with much force on the rough iron guard rails on each side of the track rails. By their action the car can be stopped anywhere on the incline or level, and in all kinds of weather. The construction of these brakes will be understood from the cross-sectional view, Fig. 3.

The loading and unloading of passengers at the ferry is quickly done, and without confusion. Near the terminus the down-track runs by a switch into the up-track, so that only one track enters the station. The down-cable continues, of course, in a straight direction, and leaves the down-track; it passes to the end of the station below the platform and around a large sheave, and then returns on the up-track. The single track in the station is flanked on each side by a wide platform. When a car arrives, it comes in by momentum, having let go of the cable some 700 or 800 feet before reaching the station. The passengers pass out of the car to the right and by the front door, and at the same time passengers enter the car from the left and by the rear door. Where the car stops to let out the passengers it remains until it has taken in passengers again, and is ready to start. One minute is sufficient to unload and load one car, or several if coupled together. The up cable is right underneath the car; the grip man lowers the rope lifter, raises the cable between the open jaws of the grip, closes them gradually, and the car moves off.

The advantages of this system are apparent: The incoming and outgoing passengers are completely separated from each other while in the station; only space enough for the single track is taken up within the station, thus leaving ample platform room at either side; and as the loading and unloading go on simultaneously, no time is lost. Possibly some such system could be applied to the termini of the Brooklyn Bridge, where the shifting of cars from track to track is now slowly performed by engines.

How to Strengthen the Memory.

Dr. Holbrook, in his February number of the *Herald of Health*, says there one feature of the memory which has not before been considered, and that is its exaltation in some forms of disease.

An exaltation is where a multitude of recollections spring up involuntarily on every hand. It has its cause in an increase of the circulation of the blood in the brain. It frequently appears in acute diseases, especially fevers. It is common in maniacal patients, and it sometimes appears as a feature of hysteria and in the early stages of brain diseases.

This subject of exaltation of memory will be best understood by some simple illustrations. There have been many accounts of persons saved from imminent death by drowning who all agree that at the moment of asphyxia they seemed to see their entire lives unrolled before them, even to the minutest detail. Some go so far as to say that every instance of former life seems to flash across the memory, not as an outline merely, but with every detail filled in with the most remarkable minutia—every act of life, whether right or wrong, comes back with great vividness. Ribot cites the case of a clear-headed man who was in the act of crossing a railroad track when an express train running at full speed appeared close at hand. The man had barely time to throw himself down in the center of the road, between the two lines of rails; and as the train rushed over him, the feeling of impending danger brought to his recollection most vividly every act and incident of his former life in such an array as to suggest to him the opening of "the great book at the last great day."

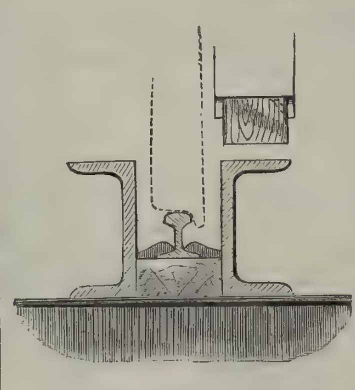


Fig. 3.—SECTION THROUGH TRACK.

There is no doubt much exaggeration in these statements; yet they show an enormous temporary increase or exaltation of the natural memory.

De Quincey, in his "Confessions of an English Opium Eater," gives an experience which shows how the memory may be exalted by intoxication by the use of opium. He says: "Sometimes I seemed to have lived from 70 to 100 years in a single night. The minutest incidents of childhood or forgotten scenes of later years were often revived. I could not be said to recollect them, for if I had been told of them on awakening, I should not have been able to acknowledge them as a part of my experience; but placed before me in dream like intuitions, and clothed in all their evanescent circumstances and accompanying feelings, I recognized them instantly."

Such augmentations of the memory may be regarded as abnormal and undesirable, being indications of disease; but they teach one lesson to those who would strengthen their memories, and that is the value and necessity of a perfectly healthy and vigorous circulation of blood in the brain. The same lesson is taught by an opposite condition from that of an exaltation—a diminution of the normal memory by a decay or withering of the brain cells and a diminished supply of blood to the parts.

The loss of memory in the aged is a familiar example, and can only be accounted for by a deterioration of the brain elements and a diminution of blood supplied to them. One of the worst features of such cases is the fact that an old person is not, for a long time after decay has begun, aware of it. I am now treating a case of loss of memory in a person advanced in years, who did not know that his memory had failed most remarkably till I told him of it. He is making vigorous effort to bring it back again, and with partial success.

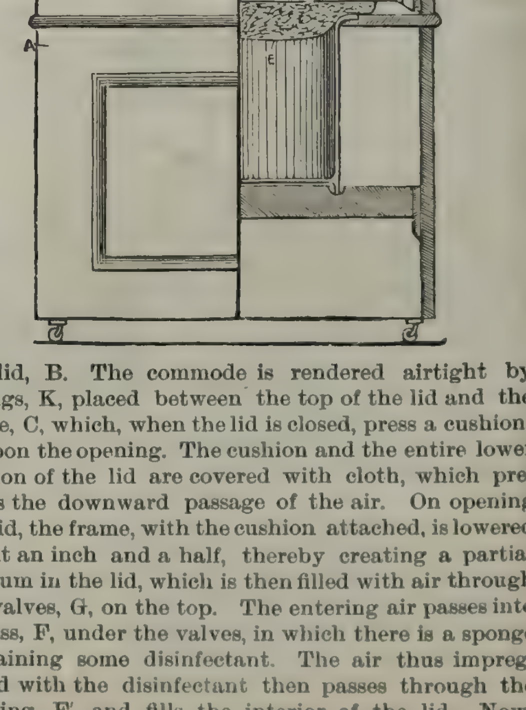
The method pursued is to spend two hours daily, one in the morning and one in the evening, in exercising this faculty. The patient is instructed to give the closest attention to all that he learns, so that it shall be impressed on the mind clearly. He is asked to recall every evening all the facts and experiences of the day, and again the next morning. Every name heard is written down and impressed on his mind clearly, and an effort made to recall it at intervals. Ten names from among public men are ordered to be committed to memory every week. A verse of poetry is to be learned, also a verse from the Bible, daily. He is asked to remember the number of the page in any book where any interesting fact is recorded. These and other methods are slowly resuscitating a failing memory.

The aged should all look to this danger in their lives, and resolve to combat it from the very first. By so doing they will make their declining years more enjoyable, and give much greater pleasure to their friends. Unceasing self-culture, especially in preserving the memory and intellectual faculties, should constitute a considerable part of the life of every aged person, even more than of the young. Only by it can this period of life be rendered pleasant and profitable.

A DISINFECTING COMMODE.

Many and varied have been the attempts during recent years to devise some means by which the sick room, water closet, etc., could be thoroughly freed of all impure air. The accompanying engraving shows a commode, the invention of Mr. Albert Eisenbach, of 2550 Edgemont St., Philadelphia, Pa., possessing many good features. It is perfectly airtight, and on being closed throws out a disinfectant, or air impregnated therewith, in sufficient quantity to free the air of the room from all disagreeable and impure odors.

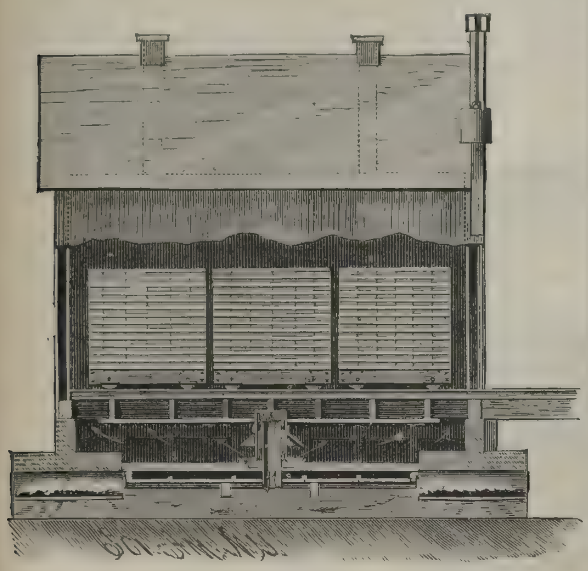
The drawings clearly show the construction of the commode. Hinged to the lower portion or body, A, is



the lid, B. The commode is rendered airtight by springs, K, placed between the top of the lid and the frame, C, which, when the lid is closed, press a cushion, E, upon the opening. The cushion and the entire lower portion of the lid are covered with cloth, which prevents the downward passage of the air. On opening the lid, the frame, with the cushion attached, is lowered about an inch and a half, thereby creating a partial vacuum in the lid, which is then filled with air through the valves, G, on the top. The entering air passes into a glass, F, under the valves, in which there is a sponge containing some disinfectant. The air thus impregnated with the disinfectant then passes through the opening, F', and fills the interior of the lid. Now, when the lid is closed, the air finds its way through the valve, H, in the front into the apartment, the air of which it immediately disinfects.

LUMBER DRIER.

This kiln is designed for drying lumber by the direct application of heat obtained by the combustion of fuel in a suitable furnace. The kiln consists of a framed structure provided with a sliding door, through which the lumber is introduced and removed upon cars running upon properly laid rails. Cold air flues are connected with the lower part of the kiln, and carried up on the outside to a level a little above the top of the roof. The smoke flues in the top of the kiln pass



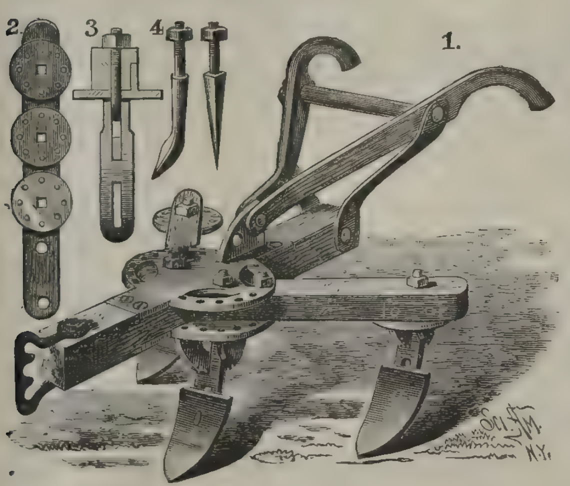
DUKE'S LUMBER DRIER.

through the roof, and carry off all the waste heat, smoke, and vapor from the lumber. In the lower part of the kiln is the furnace, which is fired from the outside at both ends. A curved iron plate covers that part of the furnace within the kiln; over this plate is an air space formed by a flat plate. Connected with the furnace is a flue extending upward into the kiln. Just above the furnace, and surrounding the flue, is a pan containing water. Over the top of the flue is a hood, reaching nearly to the surface of the water. A guard plate is secured round the hood, so as to cover the exposed portion of the pan. The hot air and gases given off from the furnace pass up through the flue and are deflected downward on to the surface of the water; sparks fall into the water, while the hot air ascends in the direction shown by the arrows into the interior of the kiln. The guard plate serves as an additional protection to throw the sparks into the water, and also prevents the pan from being filled with any rubbish falling from above when the kiln is being filled with lumber.

This kiln is the invention of Mr. O. A. Duke. Further particulars can be had from Messrs. Bivings, Duke & Co., of Clanton, Ala.

COMBINED PLOW, CULTIVATOR, AND HARROW.

Secured to the upper and lower sides of the central beam are two plates, the side parts of which are made semicircular and are formed with a series of holes near their edges, and also with holes at the centers of the circles to receive bolts which hold the side beams; by



COMBINED PLOW, CULTIVATOR, AND HARROW.

removing the outer bolts the side beams can be swung upon the inner bolts, as pivots, into any desired position, where they can be secured by replacing the bolts. The standard of the center plow passes through center holes in the plates, and is held by a nut screwed on its upper end. The side standards pass through circular plates held to the lower sides of the outer ends of the side beams and through tne beams, and are held by nuts. The standards, Fig. 3, are made in two parts, hinged to each other near the lower sides of the beams; the lower parts are curved forward to bring them into proper position to receive the plows, which are held by bolts passing through slots in the ends of the standards. Near the edges of the circular plates are holes to receive the ends of curved bars which pass through the upper ends of the lower parts of the standards. The lower edges of these bars have teeth that support the lower parts of the standards. With this construction the pitch of the lower parts of the standards can be readily adjusted. The ends of the curved center bar are inserted in holes in the lower plate. The handles are constructed as shown.

The side beams can be arranged as shown in Fig. 1, or one or both can be swung forward, according to the work to be done. When the plow is to be used as a cultivator, the side beams, Fig. 2, are used. The shanks of the cultivator teeth, Fig. 4, pass through the circular plates, which, in this case, are held from turning by pins which enter holes in the plates, so that the teeth can be adjusted as the position of the beams may require. When used as a harrow, side beams are employed, having holes to receive the harrow teeth shown in Fig. 4. It will be seen that, no matter in what position the plow may be adjusted, it will be firm and strong.

Additional particulars concerning this invention can be had by addressing Messrs. C. Audirsch and W. W. Strickland, of Gurdon, Ark.

Axial Change of the Earth.

On the last day of the year, the earth was in perihelion, or at its nearest point to the sun. At that time, the distance between the two bodies was about three million miles less than during our northern summer, in July. Though the earth now receives six per cent more light and heat, the northern part of its axis being turned away from the sun gives us the cold of winter. There is, however, a greater equality of temperature—bad as we are apt to call it, when the daily range may be from forty to fifty degrees—on account of this proximity of the earth and sun in winter and their distance in summer. In the southern hemisphere, the extremes of temperature would be almost unbearable under the present regime, were the land disposed as at the north; for there the conditions are reversed, and the sun is nearer in summer than in winter. The effect, however, is largely counterbalanced by the great predominance of water in that hemisphere. Less marked extremes are possible in the presence of such large bodies of water than would be the case at our own land-engirdled North. But the present order of things is not permanent. Nature is never stationary, and after some thousands of years the orbit of the earth will be changed. Other things being equal, the extremes of heat and cold in the northern hemisphere will then be unprecedented.

ADJUSTABLE DOUBLE BEDSTEAD.

The bedstead is provided with four hollow legs open at the top, and united by the head and foot pieces and the side rails; within these legs are sliding posts united by end pieces and side rails, which pass through vertical slots in the legs when the upper bed is lowered. In the foot piece of the main bedstead a drum is jour naled; mounted on the shaft of the drum at the outside of the foot piece is a ratchet wheel provided with a handle for turning it. Secured to the bottom of each sliding post is a rope; all four ropes are carried over suitable pulleys to the drum, which is formed with four grooves, one for each rope.

When the bed is not in use, the upper section rests upon the lower; if but one person is to occupy it, no change is necessary. But if it is to be occupied by two persons, the drum is revolved, and, winding up the cords, the sliding posts are lifted up and out of the top of the legs. Latches in the hollow legs engage with racks on the sliding posts, and hold the upper section at any desired elevation. A cord passes from each latch to a slide in the foot board; by pulling this slide all the latches may be withdrawn to release the sliding legs and permit the upper section to be lowered. This double bedstead only requires the space now taken by a single bed; it can be quickly adjusted at any desired height, and the upper section can be easily lowered. The mechanism is so simple as not to be liable to disarrangement.

This invention has been patented by Mr. A. T. Schlichting, of 1986 Third Avenue, New York city, who will furnish all further information.

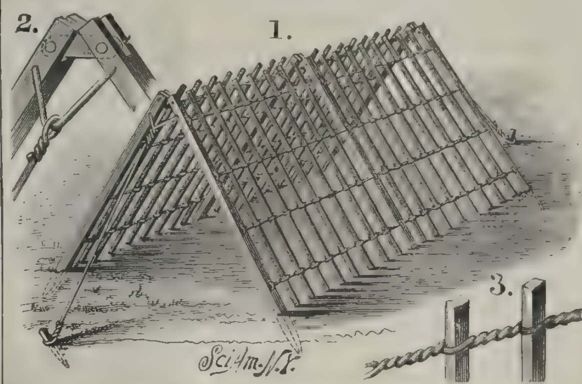
SCHLICHTING'S ADJUSTABLE DOUBLE BEDSTEAD.

A Fortune for a Patent.

The *Mechanical Engineer* says that Benjamin Lauth, Sr., the inventor of the process of making nail plate out of old steel rails, has sold the right of his patent to five Eastern firms. Mr. Lauth claims that by his process at least $10 per ton can be saved on the manufactured product, as compared with the present methods of production. Mr. Lauth will receive $150 per day for one year and $300 per day for the remaining sixteen years of the life of the patent.

TRELLIS FOR GARDEN CROPS.

The portable garden trellis here illustrated is for use in growing peas, tomatoes, and other crops requiring support; it may be folded up and put away when not needed. The view, Fig. 1, indicates two continuous sections, composed of independent side frames, inclined toward each other and united at the top. Each frame has a picket at each end and intermediate bars or wires arranged parallel with the pickets, but of less length, so that when the pickets are driven into the ground the bars will only come to the surface. The pickets and bars are united by any number of rows of wires. The upper ends of the pickets are hinged together, as shown in Fig. 2. When set up, the trellis may be held firmly by ropes attached to the upper ends of the end pickets, and secured by stakes driven into the ground. In applying the trellis to supporting peas and beans, the



WHITE'S TRELLIS FOR GARDEN CROPS.

plants will be inside, while tomatoes should be outside of both the opposite frames.

The use of this trellis, which has been recently patented by Mr. Wm. A. White, of Staatsburg, N. Y., will enable the grower to produce a larger crop from the same amount of ground than by the use of pea brush or stakes, and will also keep the vines and fruit in a cleaner condition.

The Causes of Sudden Death.

The recent sudden death of Vice-President Hendricks, followed so soon by that of William H. Vanderbilt, naturally invites inquiry into the causes which produce these startling effects.

An editorial in the *Medical News*, of Philadelphia, states that disease of the vascular system—the arteries and veins—is most frequently responsible for this mode of death. The greatest strain in the case of those subject to mental anxiety or excitement is borne by the circulatory system; and the slow and unsuspected course of the disease gives no warning in most instances, and death ensues either from a rupture of some of the large vessels near the heart, or, as in Mr. Vanderbilt's case, one of the more important blood vessels in the brain proves to be the weakest link in the chain, and death from apoplexy results.

The *Daily News* of Philadelphia, referring to the article in the *Medical News*, adds: "There is no treatment which will prevent this class of sudden deaths, and physicians are powerless to avert its onset. All they can do is to advise a calm, unexciting mode of life, with freedom from worry and anxiety. Such advice is very easy to give, but as difficult to follow as would be a suggestion that it is not advisable to die at any given time."

THE USE OF NATURAL GAS AT PITTSBURG.

It has only been within the past few years that natural gas has been utilized to any extent, in either Pennsylvania or New York. Yet its existence has been known since the early part of the century. As far back as 1821, gas was struck in Fredonia, Chautauqua County, N. Y., and was used to illuminate the village inn when Lafayette passed through the place some three years later. Not a single oil well of the many that have been sunk in Pennsylvania has been entirely devoid of gas, but even this frequent contact with what now seems destined to be the fuel of the future bore no fruit of any importance until within the past two or three years.

It had been used in comparatively small quantities previous to the fall of 1884, but it was not until that time that the fuel gave any indication of the important role it was afterward to fill. At first ignored, then experimented with, natural gas has been finally so widely adopted that to-day, in the single city of Pittsburg, it displaces daily 10,000 tons of coal. The change from the solid to the gaseous fuel has been made so rapidly, and has effected such marked results in both the processes of manufacture and the product, that it is no exaggeration to say that the eyes of the entire industrial world are turned with envious admiration upon the city and neighborhood blessed with so unique and valuable a fuel.

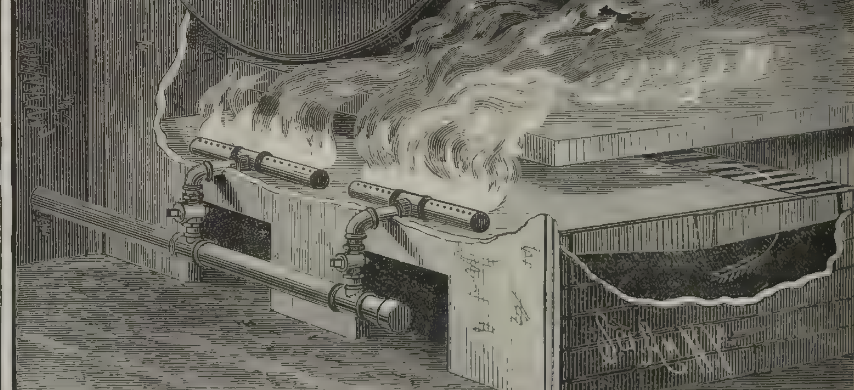
Where the gas comes from, and how long it is going to last—and where it is going to, we might add, now that the scheme of piping it to distant cities is under consideration—are questions which involve so many elements for discussion that we do not propose to take them up at present. The manner of distributing and utilizing the gas, and the industrial revolution its introduction has effected, are more than sufficient to occupy our space. As many of these facts are still involved in mystery to a large majority of our readers, it will, perhaps, be advisable to start at the well itself, and from there follow the gas in its various wanderings until it is finally consumed in the mills and works or in the home.

The regions in which natural gas is found are for the most part coincident with the formations producing petroleum. This, however, is not always the case; and it is worthy of notice that some districts which were but indifferent oil producers are now famous in gas records. The gas driller, therefore, usually confines himself to the regions known to have produced oil, but the selection of the particular location for a well within these limits appears to be eminently fanciful. The more scientific generally select a spot either on the anticlinal or synclinal axis of the formation, giving preference to the former position. Almost all rock formations have some inclination to the horizon, and the constant change of this inclination produces a series of waves, the crests of which are known as anticlines and the troughs as synclines. Many drillers suppose that the gas seeks the anticlines and the oil the synclines, but others, equally long-headed, discard entirely all theory of this kind, and drill wherever it may be most convenient or where other operators have already demonstrated the existence of gas. It will surprise many of our readers to know that the divining rod, that superstitious relic of the middle ages, is still frequently called upon to relieve the operator of the trouble of a rational decision.

The site having been selected, the ordinary oil-drilling outfit is employed to sink a hole of about six inches in diameter until the gas is reached. In the neighborhood of Pittsburg, this is usually found at a depth of 1,300 to 1,500 feet, in what is known as the Third Oil Sand, a sandstone of the Devonian period. Where the gas comes from originally is an open question. When the driller strikes gas, he is not left in any doubt of the event, for if the well be one of any strength, the gas manifests itself by sending the drill and its attachments into the air, often to a height of a hundred feet or more.

The most prolific wells are appropriately called "roarers." During the progress of the drilling, the well is lined with iron piping. Occasionally this is also blown out, but as a rule the gas satisfies itself with ejecting the drill. When the first rush of gas has thrown every thing movable out of its way, the workmen can approach, and chain the giant to his work. The plant at the well is much simpler than one would suppose. An elbow joint connects the projecting end of the well piping with a pipe leading to a strong sheet-iron tank. This collects the salt water brought up with the gas. Ordinarily, about half a barrel accumulates in twenty-four hours. A safety valve, a pressure indicator, and a blow-off complete the outfit. When the pressure exceeds a prescribed limit, the valve opens, and the gas escapes into the blow-off. This is usually 30 feet high or more, and the gas issuing from the top is either ignited or permitted to escape into the atmosphere. The pipe line leading from the tank to the city is of course placed underground. Beyond a little wooden house, the blow-off, and a derrick, the gas farms differ little in appearance from those producing less valuable crops. The pressure of the gas at the wells






THE USE OF NATURAL GAS AT PITTSBURG.

varies considerably. It is generally between 100 and 325 pounds. As much as 750 pounds per square inch has been measured, and in many cases the actual pressure is even greater than this; but, as a rule, it is not permitted to much exceed 20 atmospheres in any receiver or pipe. The maximum pressure in the lines of the Philadelphia Company is 340 pounds. The supply of Pittsburg is largely in the hands of this organization, and drawn from its wells at Tarentum and Murraysville. A number of other companies are also in the field, but the chief business of the city is still controlled by the Philadelphia. The question of pipeage is one of immense importance, and with increased knowledge of the best conditions for securing an even flow of gas becomes even more prominent, for the lines are being rapidly extended in length, and it is asserted by many practical gas men that they will some day reach the seaboard.

The pipe lines of the Philadelphia Company vary in diameter from 4 to 10 inches. The Chartiers Company, however, have one line of 16 inches in diameter. In the city, the distributing mains are from 4 to 24 inches. The general tendency is to an increase of diameter, in order to lessen the friction and enable the supply to meet any unexpected demand without interfering with the usual flow. The average diameter of the city mains may be stated at 16 inches. The distributing pipes vary from 4 to 10 inches. The pipe lines have to be laid with the greatest care, to withstand these high pressures and avoid leakage. They cost from $2,000 per mile for pipes of 4 to 8 inches up to $30,000 for 24 inches. The Philadelphia Company alone has about 375 miles of pipes 4 inches in diameter and over.

Every day, line walkers go over the entire line, and submit reports of its condition to the central office. Every leak, no matter how small, is included in the report. In addition to this daily inspection, a man is sent by the company to every fire, and it is his duty to turn off the gas from the burning building and from any that may be in immediate danger. The question of pressure throughout the lines is one of vital importance, and its regulation demands constant attention. For this purpose, valve houses, or stations, to the number of 22, have been established at various points on the line as well as in the city, and at Tarentum, Murraysville, and Dick Farm. At each of these stations the pressure is registered every hour. The company has four telephone lines of its own, of a total length of about 80 miles, and each station is connected with the central station on Penn Avenue. In this way the supply all over the city is closely watched.

Should it become deficient in any district—which would be indicated by a marked decrease in the pressure—it is but a moment's work to call up the central station, and have more gas turned into the needy district. An early disadvantage in using natural gas was its constant liability to failure, but this system of telephonically connected stations has done away with this, and created a confidence in the reliability of the supply. The arrangement of the pipeage and gates at these stations is shown in our diagram of the Willow Grove Station. Coming, as most of the gas does, a distance of twenty miles or so, its pressure is much reduced during the journey by friction against the sides of the pipes. It is contrary to law to maintain a pressure of more than 15 pounds within the city limits. Consequently, blow-offs are established at various points; and whenever the pressure exceeds 10 pounds, the safety valve opens, and the gas escapes.

This leaves a margin of five pounds, but in some of the older and smaller pipes the pressure does sometimes exceed 15 pounds, as a heavier force is needed to overcome the increased friction.

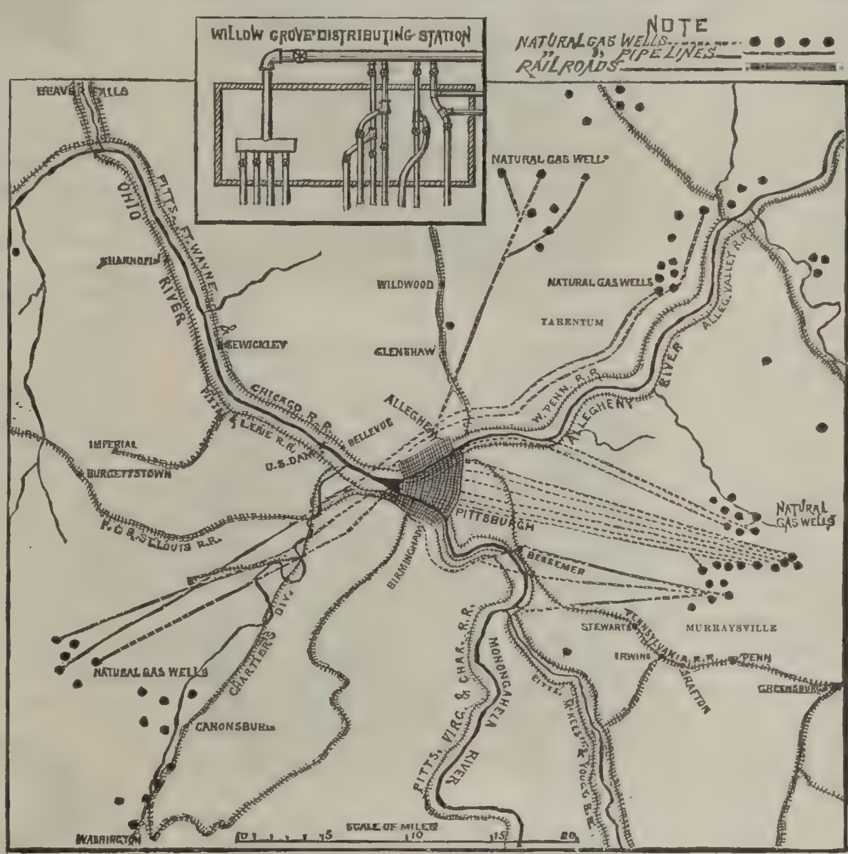
During the day, when the mills are running at full force, the pressure in the city mains is from 2 to 5 pounds; but at night, and more particularly on Sundays, the pressure becomes greater, and large volumes of gas escape at the top of the blow-offs. The one on the Allegheny River at the foot of 10th St., shown in our illustration, Fig. 1, as it appears on Sunday evening, is 40 feet high, and perforated at its upper end for a distance of 3 feet. The immense flame, 40 to 60 feet long, as it is blown about by the wind, has the appearance of a giant torch. To a stranger there are few sights more striking than that presented when he looks down from one of the surrounding hills, and sees the city at night illuminated by these lurid flames. The custom of keeping these torches lighted is not maintained, however, entirely for scenic effect, but in many cases is intended to avoid the noise of the escaping gas. At such a height, the gas would do no damage, if permitted simply to escape into the air. Having a specific gravity of only about half that of air, it is dispersed immediately into the upper regions of the atmosphere.

There are now few mills or furnaces in Pittsburg or the vicinity that are not using gas exclusively. At the Edgar Thomson Steel Works, at Braddocks, the gas is used in all departments where coal was formerly employed. The furnaces used for reheating the steel billets, that are afterward rolled into rails, are shown in Fig. 2, and will give some idea of the scale upon which this immense establishment has been built, and the importance which such a change of fuel means. If one has visited Pittsburg in the days of coal and smoke, he has only to go on the streets and notice the comparatively clear atmosphere and the clean faces to realize what a blessing natural gas has been, aside from its economic value. In the boiler room the change is no less marked. The bricks are neatly whitewashed, the iron work painted, and the engineer sits in one corner of what might be a parlor as far as neatness goes, quietly watching a water gauge and indicators. The best arrangement for burning the gas under the boiler is that practiced by the Electric Light Company at their central station in Virgin Alley, shown in Fig. 3. The gas passes into a 4 inch drum extending in front of the boilers, and thence by a 1½ inch pipe into T-burners in the front of the fire-box. These are simply perforated pipe, 2 inches in diameter.

The air for combustion is first heated before mixing with the gas. Sheet iron is placed upon the grate bars to within about 4 inches of the rear, and 2 inch tiles are placed between this and the boiler, leaving sufficient space in front for the flame to play over them. The air enters beneath, and passing along the under side of the tiles, is heated before coming in contact with the gas. It is very important at such an establishment to be able to burn coal at very short notice, should any accident happen to the gas supply. As at present arranged, the entire change can be made and a coal fire started within eight minutes. The gas is burned under the boilers at a pressure of from three-fourths to one pound. As the pressure in the mains is considerably in excess of this, it must be reduced by an automatic regulator. In dwelling houses the gas is seldom burned under more than 2 to 6 ounces.

The regulator, Fig. 6, is a very important piece of apparatus, as it must be used in every mill or house where natural gas is burned, as well as in regulating the pressure where the mains enter the city limits. It is not understood, even by the majority of the people who use it; but if the reader will follow closely our description, he will at least be able to get a general idea of its action. The city inlet terminates in a small cast iron chamber, having two valves on opposite sides. These valves are on the same piston rod, and consequently, when this is moved, one opens toward the interior and the other toward the exterior of the chamber.

A second chamber is divided into two parts by a rubber diaphragm, the upper portion being in communication with the atmosphere, and the lower with a space surrounding the small chamber first mentioned. The diaphragm is weighted above, and below acts upon an elbow lever connected with the valve rod. It will be understood that the lever is in the chamber under the diaphragm, and that the valve rod operates in the inclosed space communicating with this chamber. Bearing this disposition of the apparatus in mind, when the gas enters the small chamber it opens the valves and passes through into the surrounding space and into the chamber under the diaphragm. As the house inlet opens from this inclosed space, the gas has now free access to the service pipes. But the gas raises the diaphragm, and through the lever closes the valves, shutting off the supply. As the gas is consumed the diaphragm sinks under its weights, and more gas is admitted. By altering the weights, the regulator may be set to deliver gas at any desired pressure less than that of the initial. Should the supply of gas be cut off, the regulator automatically locks itself, and will deliver no gas until locked by hand. This prevents the escape of gas, should it be put out by a temporary failure of the supply and then turned on again. As it is so largely composed of marsh gas, it forms, when mixed with air, an explosive compound similar to the deadly fire damp of the coal mines. Consequently, fire must be applied to the orifice before the gas is turned on, or else there will be an explosion. To avoid such a possibility, a small jet of gas is often allowed to burn all the time, in order to light the larger burner as soon as it is turned on. The new fuel is becoming extremely popular for domestic use. In grates, a flat perforated box, as shown in our engraving, Fig. 5, is commonly placed in the bottom, and covered with fragments of fire clay. In cook stoves, Fig. 4, T-burners are used, generally in pairs, though usually only one is lighted unless a large amount of hot water is wanted in the boilers. In round stoves, it is common to use simply the Bunsen burner without the box attachment. The price of gas is usually a matter of contract, based upon former coal bills or upon the mill product. In Allegheny City, however, it is sold at 10 cents per thousand feet, and at this rate may be a little more expensive than coal, but is used nevertheless on account of its great convenience. There have been a number of distressing accidents attending the use of the gas, but the total fatality, it is well to remember, is much less than that of a single mine disaster such as that at Nanticoke.



THE NATURAL GAS REGION.

The Rhododendron.

As the *Farmers' Gazette* remarks, the rhododendron has advanced wonderfully and properly in public estimation, and a few hints as to peculiar points in its cultivation may not be out of place. First, looking out of doors at those which grow without protection, a general complaint is that some years they have no bloom.

There are certain matters, an attention to which will insure it every year. As soon as any flower, or rather bunch of flowers, is past its prime, it should be taken off as close up as possible to the under flower, because, as there are embryo branches in every part of the stem, the strength of the plant will be immediately devoted to the production of some of them; whereas, if the seed pods are left to swell, they require the energies of the plant, and take it from new branches. Another point to remember is that from the first instant the bloom buds begin to burst, the plants should be watered copiously, and this should be continued every four or five days until the bloom buds have set again for next season. Even the rain may not reach the roots, as these plants are of themselves such a complete cover to the ground. Rhododendrons, however, when planted in a hollow, rarely miss bloom or require water. The proper soil for the rhododendron is a turfy peat, with a little turfy loam, three parts of the peat and one of loam, and wherever this kind of soil abounds, they do well.

In growing the plants of the half hardy and tender kinds in pots, the same description of soil is used; the watering is increased at the same seasons of growth, and the shifts from one pot to another take place at the periods when the pot is full of roots; but the shift should be just before the buds swell for bursting the bloom. Seed should be sown in pans, and the plants pricked out as soon as they can be well handled—three or four in a three inch pot; when they have attained sufficient size, they may be potted singly, if tender or doubtful, and have] the protection of a frame all the winter. They may be grafted or in-arched, and, if desirable, budded; but as one eye and an inch of wood is enough for a graft, that is the best mode of propagation. The handsomest grafted plants are made from the ends of shoots. If seedlings are hardy, they may be bedded out six inches apart one season, twelve inches the next, and there they may remain to bloom. Layering is also a favorite mode of propagation, though it takes a year to root properly.

AN 8-foot vein of fire-clay has been struck at Saltsburg, Pa.

FARQUHAR'S BURGLAR PROOF SASH LOCK.

This is an entirely new device for securely locking windows, and is a lock that cannot possibly be opened from the outside by the use of instruments, and is said to be the most secure burglar proof sash lock that has ever been presented to the public.

It is manufactured from the best material, and is in all respects neat in appearance, simple in construction, and easily worked. Being placed in the pulley-style, at the side of the window, it is out of the way, and the large and bungling sash lock usually placed in the center of the sash is done away with. A very small fastener may be used in connection with it to draw the

FARQUHAR'S SASH LOCK.

sashes together, so as to prevent the wind and dust from getting in.

It is automatic in its working, and when the sashes are closed they are always securely locked. If it is desired to leave the upper sash open for ventilation, it may be just as securely locked there as when closed—the lower sash being kept in its place closed, and the upper one locked securely to it.

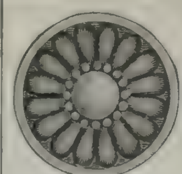
Every owner or occupant of a house has realized the importance of some better and safer means of locking their windows than the market has heretofore afforded, and this lock exactly fills that need. The simple fact of the windows being closed is an assurance that they are securely and safely locked.

Chandler & Farquhar, 171 Washington Street, Boston, are the manufacturer's agents, and would be pleased to furnish any additional information desired.

MOSELEY REVERSED PRESSURE DOOR AND GATE SPRING.

This spring will close any kind of door or gate, whether large or small, and the tension can be regulated at pleasure. Can be placed on either side of the door and detached when required, and never leaves the door ajar. For gates, car, office, and water closet doors no other fastening is necessary.

These springs are having a large sale, and will stand the wear and constant usage to which they are subjected. Chandler & Farquhar, 171 Washington Street, Boston, are the sole agents, and would be pleased to furnish additional information and illustrated circulars.



RNAMENTAL PRESSED WOOD BLOCKS FOR BUILDERS.

The Taft Company, of Hartford, Conn., manufacture a large line of corner blocks, panel pieces, borders, round and square rosettes, etc., made in black walnut, cherry, oak, ash, maple, mahogany, whitewood, etc., which are especially adapted for inside house finish, stair posts, newels, etc., which give fully as good effect as hand work, and at a much less cost.

ORNAMENTAL PRESSED WOOD BLOCKS FOR BUILDERS.

We give illustrations of several new designs just produced by this company, and would advise all of our readers in need of pressed wood ornaments to send to the Taft Company for their illustrated catalogue and price list.

The Fossil Wood of the West.

An interesting paper has been communicated to one of the California scientific societies on the fossil wood which is found in different localities throughout the State.

This silicified wood is stated to be a variety of quartz; the wood fiber is gradually replaced by quartz, leaving the form of the wood intact, so much so that sections cut and placed under a microscope show the characteristic grain of the wood, by which the genera may often be determined, and sometimes the species. In what is known as the petrified forest in Colorado, where are stumps of trees several feet in height and some twelve or fifteen feet in diameter, one stump seemed to have been fossilized while in a charred state, and from it fossil charcoal was obtained. Many of the specimens of wood are incrusted with layers of crystallized chalcedony of an opalescent tint, so beautiful that sections have been mounted and worn as jewelry. In Wyoming there have been found sections of trees 20 inches in diameter and several feet in length, like hollow tubes, with the interior surface entirely studded with pure quartz crystals, presenting a most beautiful appearance.

THE WEAR OF WINDOW CORDS.

Almost every householder has had more or less annoyance from broken window cords, and has mentally or outwardly avowed his detestation of the architect and contractor who supplied his building with inferior lines, at a saving in first cost of three or four cents per window, and thereby entailed upon him the future annoyance of being unable to operate the sash, and final expense of replacing the cords at 50 cts. per window for labor.

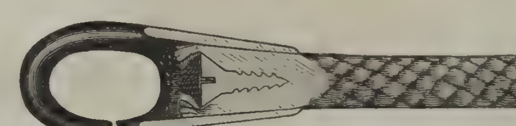
As the inconvenience of replacing cords is so great that it is seldom done without calling in a carpenter, it becomes a matter of greater importance than is usually allowed it to secure the best lines for use in building; for any small saving possible in first cost will be paid out over and over in repairs.

SAMSON SASH CORD.

Some interesting experiments have recently been made, in the wear of window lines, to determine the relative value of different materials and methods of manufacture, under the conditions usually imposed in practice. Many architects, knowing the great tensile strength of Italian hemp and linen cords, always insist upon their use in first-class jobs. The recent tests, however, have confirmed many previously made, as well as the experience of old builders, that these fibers are not sufficiently pliable to stand the constant bending over a window pulley; and show that the softer and more pliable yarns of cotton will, when bound together by a suitable braiding process, bear the constant bending through a much greater length of time. The tests have also shown, further, that the kind of braid makes a great difference, and that all cotton cords have not the same value.

In these experiments, an ordinary steel-axle window pulley, with turned face, was used, the same as is generally employed in the better class of buildings. The cord was arranged to raise a 25 lb. window weight, lifting it 18 inches, 22 times per minute.

The following figures, showing the length of time the different cords lasted under this test, in connection with the cost of the cords, shows how great a saving



SAMSON BELL CORD COUPLING.

can sometimes be made by using sufficient care in purchasing.

In every case the time as given is the average obtained from several tests.

Best Linen Shoe Thread.—Hawser laid, $\frac{5}{16}$ in. diam., weighing 42 lb. per doz., and costing the contractor 60 cts. per lb., or $25.20 per 1,200 ft.; average wear, 60 hours.

Cable Laid Italian Hemp.—1st quality, $\frac{9}{32}$ in. diam., weighing 35 lb. per doz., and costing the contractor 32 cts. per lb., or $11.20 per 1,200 ft.; average wear, 62 hours.

Silver Lake braided cotton, 1st quality, ¼ in. diam., weighing 26 lb. per doz., and costing the contractor 40 cts. per lb., or $10.40 per 1200 ft.; average wear, 96 hours.

"Samson" braided cotton, ¼ in. diam., weighing 26 lb. per doz., and costing the contractor 40 cts. per lb., or $10.40 per 1,200 ft.; average wear, 261 hours.

This great difference in favor of the Samson cord is owing largely to the method of manufacture, the braid being an improvement on that employed by other manufacturers. In the Samson braid each strand entwines four others at every stitch, they are pulled very firmly into place, and the cord is carefully finished with sizing.

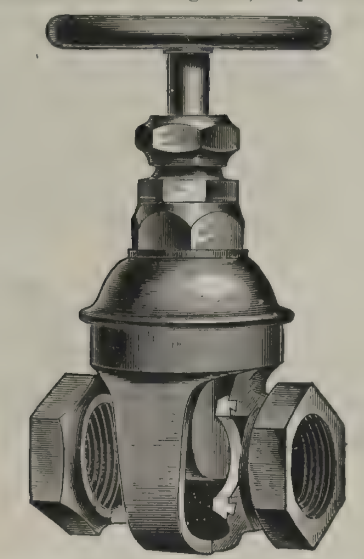
The Samson Cordage Works, Messrs J. P. Tolman & Co., proprietors, No. 166 High St., Boston, make these cords in a great variety of sizes and for various uses.

Large quantities of the cord are used for bell line in railroad cars; and a very neat and secure coupling is made by the firm for joining the ends of the cord between the cars.

They also apply, at small extra cost, a waterproofing mixture to their cords, which much increases the life, whether the cords are exposed to the weather or used for window lines.

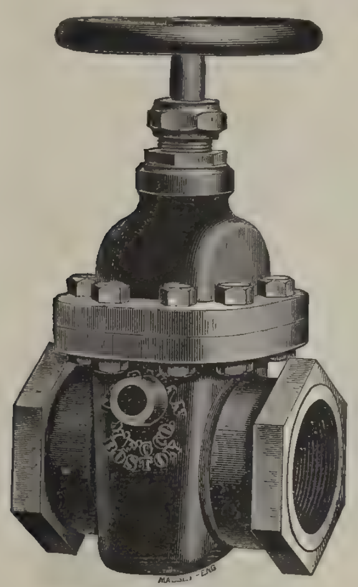
CHAPMAN VALVES AND HYDRANTS.

The valves and hydrants made by the Chapman Valve Manufacturing Co., Mason Building, Boston, Mass., have earned a very desirable reputation. They have been before the public ten years. Judging from the rapid growth of the company's business and the testimony of all who have used their goods, they have succeeded

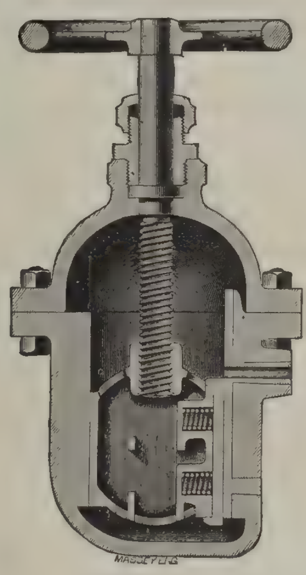


COMPOSITION STEAM AND WATER VALVE.

in accomplishing the purpose with which they originally started out, the production of a superior valve and hydrant. They have sought to combine in their goods a simple and graceful construction, good material and workmanship, interchangeability of parts, and ease of manipulation. To this end the factory at Indian Orchard, Mass., has been constantly enlarged, and new and improved machinery added to the plant, until it is now the most complete establishment of the kind in



AUTOMATIC DRIP VALVE.

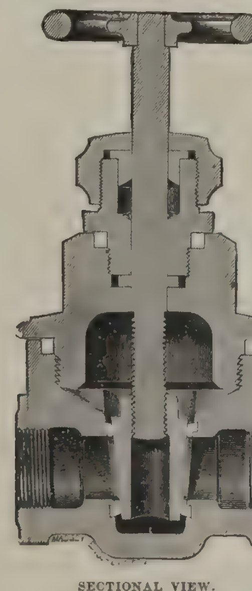


SECTIONAL VIEW.

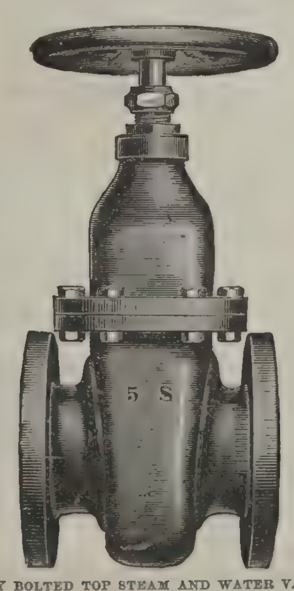
IRON BODY VALVE.

the country. The Chapman gate valve has a clear passage, the full diameter of the connecting pipe, and this may be called its characteristic feature. In details, the valve varies considerably, according to the service to which it is to be put and the pressure which is to be brought upon the gate. Of the numerous special forms manufactured by the company, we select a number which are more particularly adapted to the use of build-

AMMONIA VALVE FOR HEAVY PRESSURE.

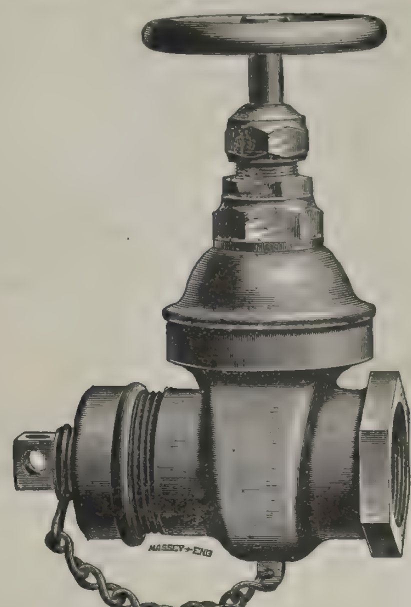


SECTIONAL VIEW.



IRON BODY BOLTED TOP STEAM AND WATER VALVES.

ers. The valve gate or plug is cast in one piece, and is made hollow and tapering. It is prevented from coming into contact with the seats until closed by splines cast on the body, which engage grooves in the side of the gate, and thus retain it always in the center of the opening. The splines are made of unequal thickness, in order to prevent the plug from being inserted improperly in case of its removal for repairs or otherwise. The gate has double faces, and is equally tight on both sides. It rises and falls on the spindle in



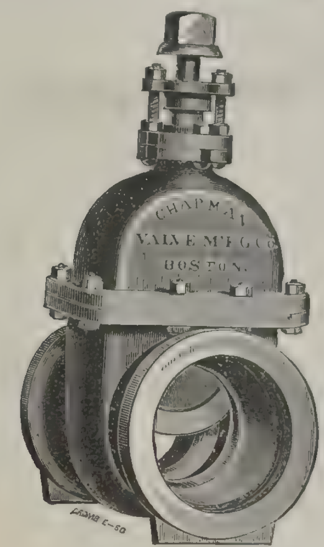
COMPOSITION HOSE VALVE.

the preferred form, but, when desired, the plug is made to move with the spindle. The composition of the spindles, all of which are made of extra diameter in order to avoid twisting, depends upon the fluid with which they are to come in contact.

For steam or water, gun metal composition is generally used, while for ammonia or gas, steel or iron is preferred. Where the valve is to be subjected to strong pressure, the parts are made unusually heavy, as shown in the ammonia valve. The seats are composed of an alloy similar to Babbitt metal, but vary with the nature of the fluids acting upon them. Their composition is decided by the material which experience has demonstrated to be the most resistant to corrosion. The seats are held to the body by means of dovetailed grooves, and are formed upon the plug itself, producing an exact counterpart of the faces of the plug on both sides, thus making a perfectly tight joint, which, by the construction of the valve, wears tighter in use, and always preserves its bearings.

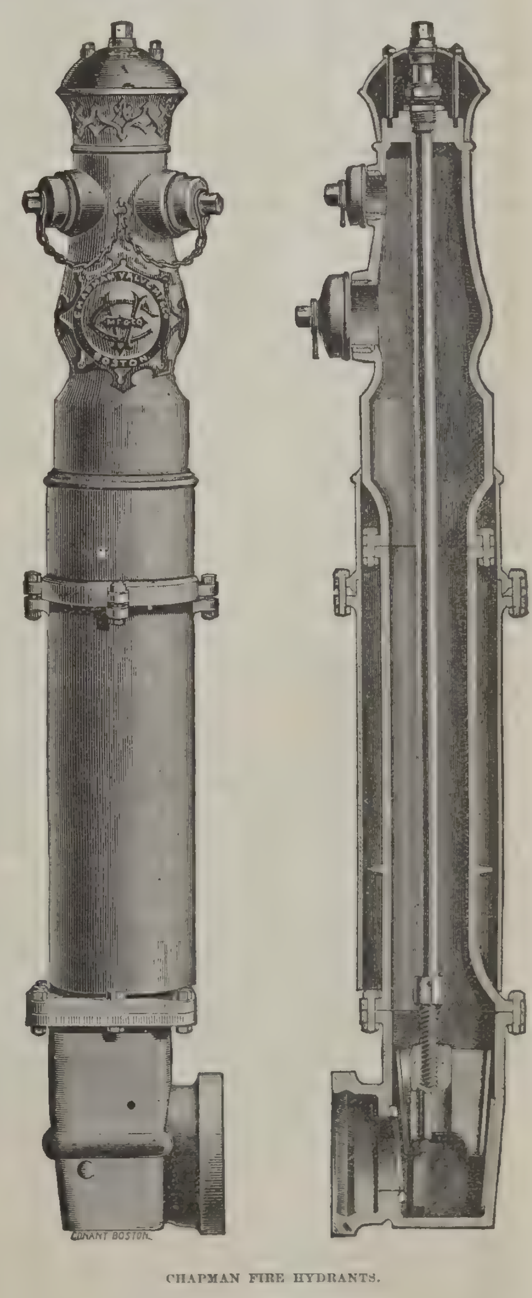
Both the plug and seat being non-corrosive, the valve works with ease, even after having been closed for years. An automatic drip valve, as shown, has been devised for cases where it is necessary to drain the water from a pipe after the supply has been cut off by closing the main valve. This obviates the need of an extra drain valve, which is apt to be troublesome, in addition to its expense.

The iron body valve, with outside screw and yoke, has been devised to meet the demand for a valve in which, from its frequent use, it is desirable to have the screw where it can be readily cleaned and oiled. Particular attention has been given to the details of the fire hydrant illustrated. In opening, the gate rises upon the spindle into a recess below the hydrant pipe, large enough to admit the full passage of water from the main, and closes vertically, gradually cutting off the flow of water and preventing any water hammer or



IRON BODY WATER GATE.

strain upon the pipe. A drip outlet is also provided on a level with the water in the main, and is opened and closed automatically by the action of the gate. As the drip outlet is always open when the gate is closed, there is no liability of freezing. Great care has been taken to make the operation of the hydrant perfectly sure and reliable. The company issues a fully illustrated catalogue, which they will send on application to those interested.



CHAPMAN FIRE HYDRANTS.

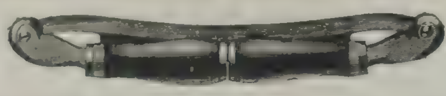
The officers of the company are: S. P. Payson, President; Percival L. Everett, Treasurer; and Jason Giles, General Manager. Their office is at 72 Kilby Street, Boston, Mass.

FOLDING AND ADJUSTABLE HANDLE DRAW-KNIFE.

Woodworkers will find this draw-knife convenient, for the following reasons:

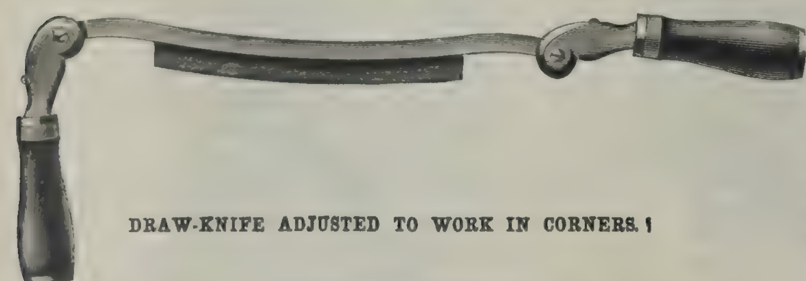
1st. An eight inch knife, with handles folded, occupies space only 14 in. × 2 in.

2d. Every carpenter knows how difficult it is to keep a draw-knife sharp when packed in chest with other tools, and will see at once the *great advantage of the folding handle*, which perfectly protects the blade from all injury.

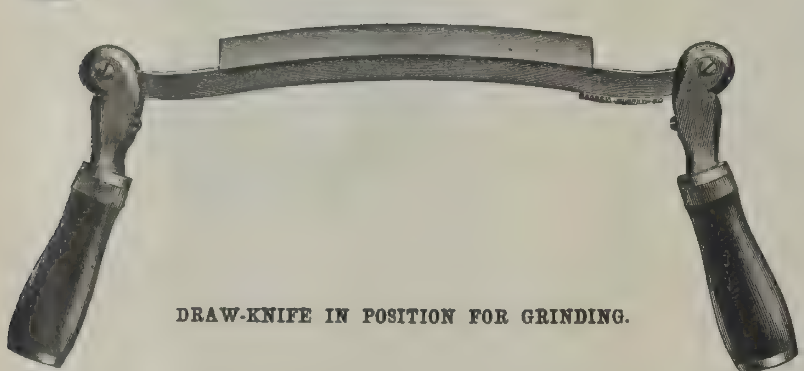


DRAW-KNIFE CLOSED TO BE SENT BY MAIL.

3d. Having a protected blade, time otherwise thrown away in grinding and putting knives in order *is saved*. And the owner need have no fear of being cut when looking for other tools packed with the knife.



DRAW-KNIFE ADJUSTED TO WORK IN CORNERS.



DRAW-KNIFE IN POSITION FOR GRINDING.

4th. The handles can be adjusted in an instant, and are held in position by a hardened steel slide.

5th. The knife blade is forged from best tool steel bars, carefully tempered and ground, thus enabling us to guarantee the cutting quality, which we warrant in every case.

To illustrate one of the many useful points of the adjustable handle, suppose a carpenter wishes to shave down work close to his bench. With the old style fixed handle knife this could not be done; whereas we simply turn out one of the adjustable handles (see cut), and the chip can be taken off as close as desired. The handles can also be changed for all close work in corners, and on wide, flat surfaces.

Again, an old style draw-knife is troublesome to grind, as the handles come in contact with the grindstone, and leave a portion of the blade unground, and it is also difficult to hold when grinding. With the Adjustable Handle Draw-Knife it is a very simple matter to turn the handles round back of the blade (see cut); a firm grip on the knife is thus obtained, and the blade can be ground on every part. In short, we have at last a perfect draw-knife, a want that has long been felt, and a tool that will often take the place of saw and hatchet to *advantage*—one that will pack *snugly* and is *light and durable*.

A. J. Wilkinson & Co., 182 Washington St., Boston, are the sole manufacturers, and would be pleased to furnish price list and illustrated circular and testimonials on application. The draw-knife can be sent by mail to any address.

A ONE THOUSAND FOOT TOWER.

In January, 1874, the Scientific American gave the drawings and details of a one thousand foot tower which was proposed to be constructed by Clarke, Reeves & Co. in Fairmount Park, Philadelphia, Pa., near the Centennial Exhibition grounds. This idea was not carried out, but it has been taken up in France.

The example of the largest buildings that have been constructed up to the present shows that it is difficult, with materials in which stone plays the chief role, to exceed a height of from 490 to 525 feet, which may be considered as a limit rarely reached. In fact, the principal heights of known buildings are as follows:

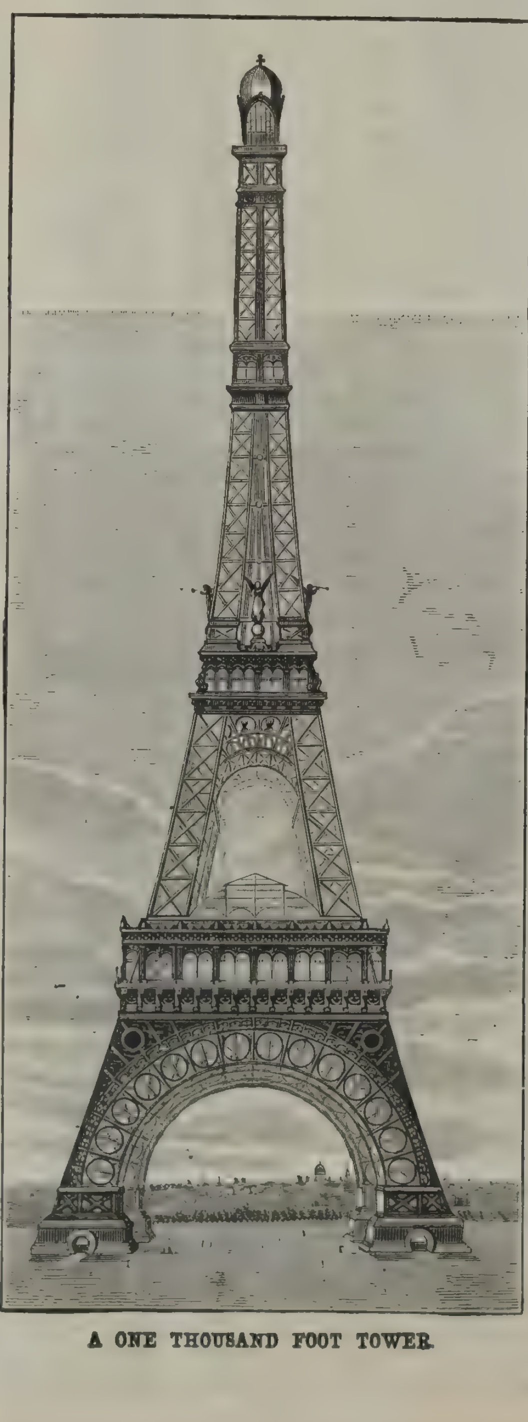
	Feet.
Washington Monument	555
Cologne Cathedral	520
Rouen Cathedal	490
Great Pyramid of Egypt	478
Cathedral of Strassburg	465
Cathedral of Vienna	452
Saint Peter's of Rome	433
Capitol, Washington	288
Spire of the Invalides	344

The tower is designed, in the mind of its projectors, to form part of the structures that will be erected on the occasion of the Universal Exhibition of 1889.

It was necessary to find a mode of construction which should limit the number of uprights, and nevertheless permit of doing away with the diagonal stays. This has been achieved by the present project, presented by Mr. G. Eiffel, the builder of the Garabit Viaduct. The framework of the tower consists essentially of four uprights that form the corners of a pyramid whose faces form a curved surface.

Each of these uprights has a square section that diminishes from the base to the summit, and forms a curved latticework 49 feet square at the base and 16 at the top. The bases of these uprights are spaced 328 feet apart. They unite at the apex, and form a platform 33 feet square. These uprights are anchored to a solid masonry foundation, and are connected at different heights by horizontal platforms that serve as a support for vast halls, which will be utilized for the different services that will be installed in the tower. The one on the first story, the flooring of which will be 230 feet from the ground, presents a superficies of about 5,400 square feet.

At the lower part, and in each of the faces, is a large arch of 230 feet opening, forming the principal element of the decoration. It gives the tower that monumental aspect which is indispensable for the purposes for which it is intended. At the apex there is a glass cupola from whence a vast panorama may be seen by the spectator. This part will be reached by elevators in the interior of the uprights, so arranged as to give absolute security. Aside from the attraction and monumental aspect that will be presented by this tower, the boldest manifestation of engineering art of our epoch, it will be susceptible of many different and important uses.—*Les Annales des Travaux Publics.*



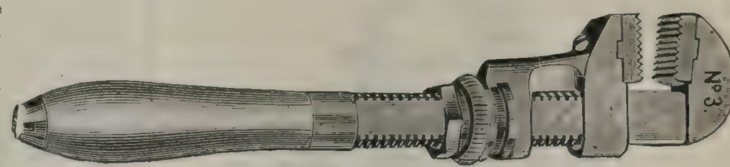
A ONE THOUSAND FOOT TOWER.

COMBINATION AND PIPE WRENCHES.

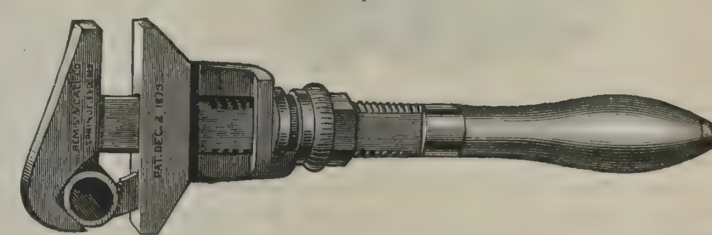
The Bemis & Call Hardware & Tool Co., of Springfield, Mass., are introducing combination and pipe wrenches that are meeting with a large sale and possess valuable features.

The combination wrench combines the qualities of a pipe wrench and also all the requisite combinations of a regular nut wrench.

The pipe wrench (Fig. 2) has serrated jaws, which are interchangeable, the same serrated plate being used for either the stationary or sliding jaw, so that if one plate is broken another can be furnished, adapted to either jaw without express designation. The slides, nuts, and various parts are also interchangeable, thus easily repairing the wrench at small cost.



COMBINATION WRENCH.



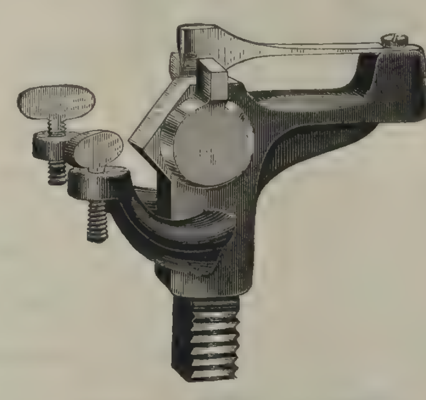
PIPE WRENCH.

This company have issued a new illustrated catalogue, which they would be pleased to mail to any one interested in their line of tools.

SPRING HAMMER SAW SET.

In this saw set simplicity and utility are combined. It is ready in operation and practical in use, and has the advantage of a construction that admits of interchangeable parts, so that, in case of breakage, the original set may be preserved by a duplication of the broken part.

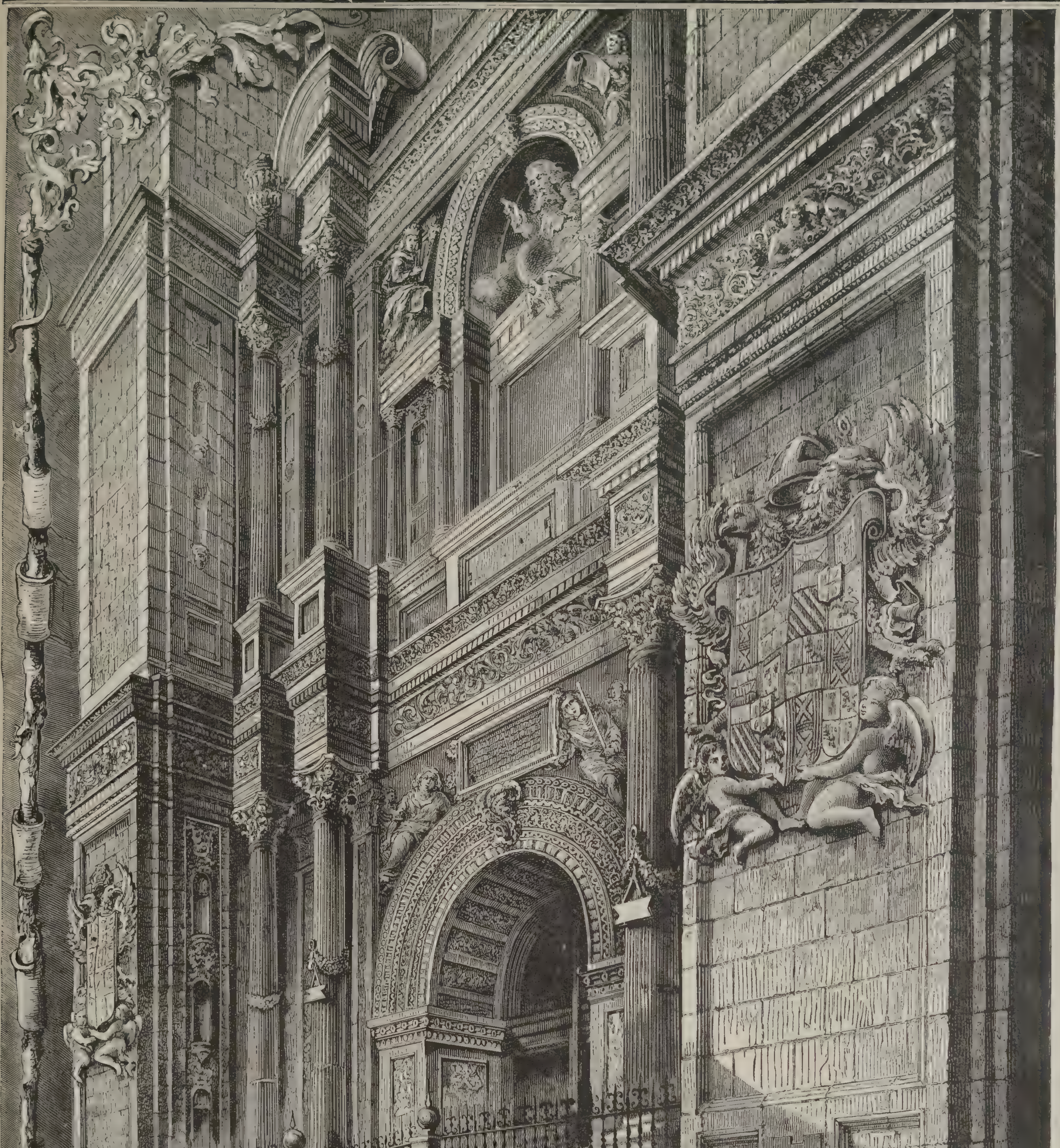
The shank of the bed piece is threaded on two opposite sides, so that it may be screwed into a block or bench, while the intermediate sides are plain, and intended to be used in a vise or any clamp where the set can be firmly held. The body is provided with arms and adjusting screws, whereby the desired angle of the saw blade may be obtained, which, in connection with the gauging ears, gives the desired set and angle to the saw tooth. The steel hammer is placed at a sufficient distance from the steel bedded beveled part beneath its point to allow the easy admission of the saw tooth. A stroke on the hammer bends the tooth over the beveled part of the body or bed piece, and sets it in compliance with the gauge of the adjusting screws and ears. The hammer recovers its natural position from the impact automatically, and has an advantage over others operated mechanically, of always being in order.



SPRING HAMMER SAW SET.

The sale of these sets, manufactured by the Bemis & Call Hardware & Tool Co., of Springfield, Mass., has already demonstrated its practical value, and its worth is conceded by all mechanics who have given it a trial.

To remove varnish from gelatine negatives, according to the *Mittheilungen*, the plate is immersed in a solution of 1 part of caustic potassa, 10 parts of water, and 90 parts of alcohol. After a few minutes the varnish film is much softened, and can be washed entirely off by rinsing the plate with alcohol. The plate can then be intensified or reduced like one that has never been varnished.



THE CATHEDRAL OF GRANADA.—THE PERDON DOORWAY.—FROM A DRAWING BY ANTONIO HEBERT.

THE CATHEDRAL OF GRANADA.

A good idea of the architectural beauties presented by some of the old Spanish churches may be gathered from an examination of the picture of the Perdon entrance or doorway of the Cathedral of Granada, herewith presented, and for which we are indebted to *La Ilustracion Espanola.* The first stone of this great edifice was laid March 15, 1529, with solemn ceremonies. The architect was Diego de Syloe; he died long before the completion of his great work. Over a hundred years elapsed before it was finished.

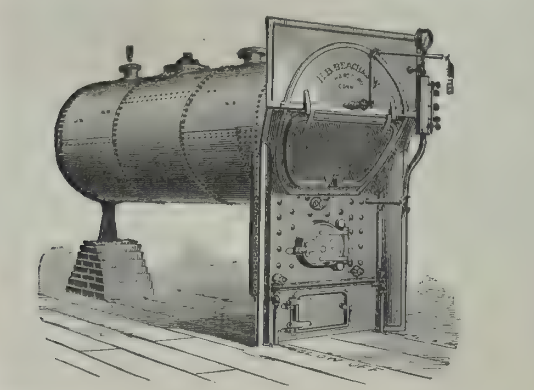
We have in this design the variety and profusion of adornments which are so characteristic of the Renaissance. The elegant arches adorned with the richest mouldings; the figures of Justice and Faith, which sustain a Latin inscription, written by the confessor of Queen Isabella; the airy columns that rise at the sides, girdled with floral wreaths and crowned with capitals, at whose corners appear little faces from between thistle leaves; the magnificent frieze and the shaded cornice of its entablature; the grand shield of arms carved on the two salient pillars; the delicate proportions of the second division, which give character to the figures of Moses, of David, and the Eternal Father—all that Syloe left complete—contribute to render this work one of the most faultless creations of ornamental architecture.

COMMON SENSE WATER FRONT TUBULAR BOILER.

H. B. Beach & Son, of Hartford, Conn., are the sole manufacturers of this boiler, which was patented by G. H. Rheutan, and possesses many new features.

The water front, being a part of the boiler, extends downward at the front about four inches below the grate bars, forming a support independent of the brick walls; and also forms the front end of the furnace, doing away with the castings and brickwork commonly used, and reducing the thickness from sixteen inches (and in many instances twenty-four) to six inches, securing this part fully against all possible chance of burning out, and making it easier to feed and clean fires.

It adds heating surface to the boiler, collects the sediment and loose scale, which, in plain boilers, is deposited upon the plates over the fire, causing them freqently to burn and crack.



COMMON SENSE WATER FRONT TUBULAR BOILER.

The currents of circulation within carry the deposit forward, where it falls through the opening into the water front, from which it is easily and quickly removed by opening the blow valves for a few seconds daily, practically making this boiler nearly, if not quite, self-cleaning.

The removal of deposit not only protects the boiler from injury, but effects a saving in fuel by enabling it to maintain its evaporative efficiency the same as when new; it is also of the greatest importance as to safety and economy, over 33 per cent of the defects found in steam boilers being caused by sediment deposited upon the plates, which could not be removed between periods allowed for cleaning.

An important feature, not seen in other boilers, is the location of the hand hole at the front end, outside and below the smoke box, thereby avoiding the dampness and consequent corrosion at the bottom of the smoke box, giving a better view of the interior, and all the access necessary beneath the tubes for thorough inspection and cleaning.

The cast iron front is secured to the boiler, which, resting on three stands independent of all walls, entirely obviates any displacement of the same from the expansion of the boiler.

Altogether, there are many excellent features about this boiler and setting which render its general care and control very convenient and economical; embodying, as it does, most of the good features of others, together with those peculiarly its own, it can be relied upon to give satisfaction.

A large number of these boilers are in use by many of the prominent manufacturing establishments, particularly in New England, and the firm of H. B. Beach & Son, as successors of the Woodruff & Beach Iron Works, are noted for the good quality of their work.

THE USES OF CORRUGATED TUBING.

We present to our readers an illustration of corrugated tubing, which is manufactured, by an improved process, by the Wainwright Manufacturing Company, Nos. 65 and 67 Oliver Street, Boston, Mass.

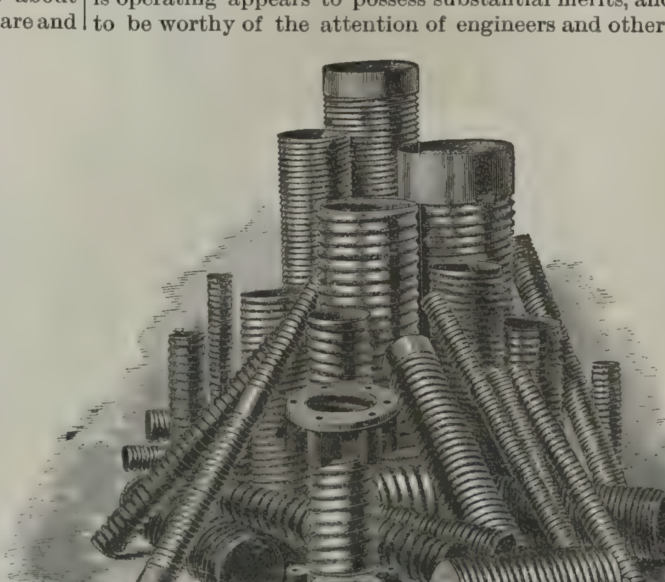
By this process, which has been perfected after a long series of experiments, it is claimed that corrugated tubes, both spiral and annular, of even thickness throughout, are produced, while perfect freedom of expansion and contraction is provided without causing any strain upon the joints and connections, which suffer so severely where plain tubes or cylinders are used. In steam boilers, for instance, and in similar mechanical constructions, subject to severe alternations of temperature in their various parts, the unequal strain to which these parts are continually exposed is one of the prime causes of their rapid deterioration; so much so, that mechanics have learned by costly experience that one of the most difficult problems to contend with is the fitting of steam and water pipes so that they shall successfully withstand the alternations of expansion and contraction. The remedy for this evil has been overcome by giving to tubes, cylinders, etc., employed in the class of structures above designated, the corrugated form, which gives an enormous increment of strength, so that its ability to resist collapse from external pressure or bursting from internal pressure is increased as much as five times when compared with a plain tube or cylinder of the same thickness and average diameter. The reason for this will be readily seen when it is considered that the corrugated form presents a succession of arches, which theory and practice agree in demonstrating to be the best disposition of material to secure its greatest resisting powers.

These facts have a very important bearing when applied to steam boiler construction. The great increase of strength derived from the adoption of the corrugated form, when applied to the construction of the furnaces and tubes of steam generators, permits of the use of a thinner tube or cylinder, which in turn permits of the more rapid transmission of heat from the fire to the water, which means economy of fuel and an improved evaporative duty.

It is apparent that where the same principle of construction is applied to structures designed for cooling or condensing purposes, an equivalent increase in efficiency will be obtained over that realized by the use of plain surfaces for tubes or cylinders, due to the increased surface given by the corrugation.

Where the corrugated form for tubes and furnaces is applied to steam boilers, there are other advantages besides those enumerated above. These consist in the fact that the life duration and safety of such structures are notably increased. These results are reached, first, from the fact that the corrugated form of construction provides such a degree of flexibility to the internal parts as to afford effectual provision against the straining of the various members of the structure by their unequal expansion and contraction. Thus, all strains from the heads of boilers are removed, the leakage of joints and fracture of connections are substantially done away with. Also, the transverse expansion and contraction of the corrugated members is affirmed to prevent the deposition of adherent scale and sediment. It appears, therefore, reasonably certain, from the above considerations, that the adoption of the corrugated form for the tubes and furnaces of steam boilers must assure such structures greater strength, greater evaporative efficiency, a longer life duration, and greater safety.

The introduction of corrugated tubes and surfaces for the purposes above named, and for others that will occur to thoughtful minds, marks a distinctive advance in the arts, and the improved process for its production which the Wainwright Manufacturing Company is operating appears to possess substantial merits, and to be worthy of the attention of engineers and others interested in this department. The company above named are producing, by their patented process, corrugated boiler tubes, cylinders, furnaces, surface or marine condenser tubes, economizer tubes, stationary or locomotive heater tubes, radiators, expansion joints, etc. In addition, they are applying their product to several patented specialties in which the use of corrugated tubing is an important element. These tubes are sold at a price which enables them to compete successfully with plain tubing for all uses.

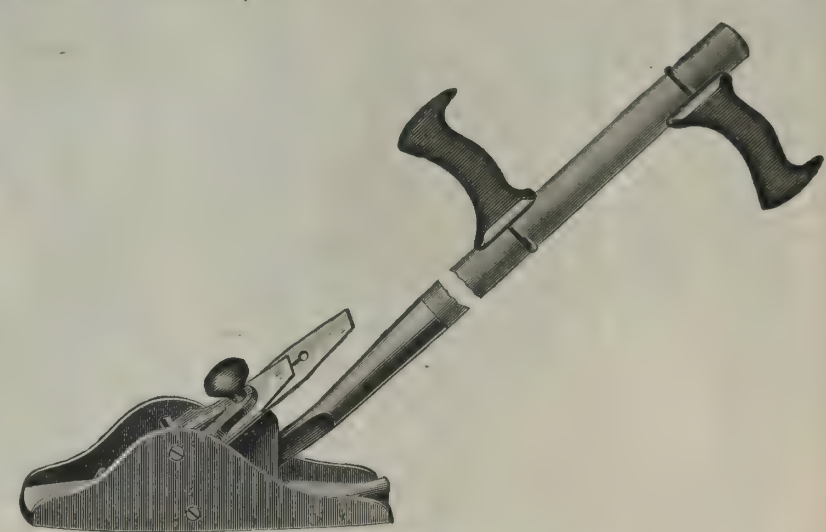


CORRUGATED TUBING.

STANLEY'S PATENT FLOOR PLANE.

The universal testimony of carpenters is that no more laborious or painful work comes to them in the whole range of their business than that of planing floors. No advantage can be taken of this sort of work; the workman must get right down to it, and work in a strained and unnatural position.

A tool has been recently offered in market which will materially lessen the discomfort of the mechanic while planing floors; and it is claimed that by its use more and better work can be done than formerly, with less outlay of strength. The weight of the plane is about ten pounds, thus requiring no pressure downward while it is being worked. The entire length of the handle is forty-five inches, and the grip can be adjusted to any desired position, the same as on a scythe-snath.



STANLEY'S PATENT FLOOR PLANE.

The Stanley Rule and Level Company, of New Britain, Conn., manufacture the floor plane, but it can be had of hardware dealers generally.

Fire from Steam Pipes.

It was asserted with confidence by the fire chiefs, a their fall convention at Long Branch, that steam pipes had been known to be the direct cause of a number of disastrous fires. The evil, in their estimation, was sufficiently grave to deserve attention from all municipal authorities. Experience in different parts of the country seemed to confirm their statement, with the one exception of Baltimore. In that city one of the commercial sheets has denied such an effect of steam heating, and questions whether a single authentic case of a fire caused by steam pipes can be brought forward. This has naturally raised a controversy, in which one side asserts the existence of overwhelming proof, and the other ridicules their belief in such fables. It is usually hard to satisfy one's self of the real cause of a fire, since there are so many possible ones; but such evidence as we have seems to clearly indicate that steam pipes not only can, but have produced very serious conflagrations. When timber is brought in contact with hot pipes, and particularly in inclosed spaces, it becomes extremely dry, and finally charred. If air be suddenly admitted, such timber is very apt to burst into flames, its thorough dryness rendering it dangerously inflammable. Experiments conducted by Mr. Damrell, in which these conditions were present, gave just such a result. A state of affairs producible at will is possible by accident, and the same result must follow. In this case, the requisite conditions are very apt to be unintentionally fulfilled, for a steam pipe is ordinarily put out of sight whenever possible, and, to economize space, is permitted to come in contact with anything that may cross its path.

As far back as the early part of 1880, Mr. Edward Atkinson gave us a number of instances in which heated pipes were the direct cause of fire. Two or three of these cases may be recalled, as they are so much to the point. A steam pipe which ran across a yard, in a wooden box, was surrounded with fine charcoal, as being a good non-conductor of heat. Within twelve hours, the charcoal was in a state of vigorous combustion. At another time, a pipe carried through a sill in contact with the wood was sufficient to cause combustion within less than twelve months. Coming from so high an authority, this evidence has the weight of conviction, and can scarcely gain anything by being multiplied.

FIRES resulting from burning oil are inextinguishable with water, but may readily be smothered by throwing flour upon the burning oil. If clothing is set on fire by spilling oil or by the bursting of a lamp, a handful of flour thrown immediately may be the means of quenching the flames and saving life.

VULCANIZED INDIA-RUBBER FOR MECHANICAL AND MANUFACTURING PURPOSES.

The introduction of rubber as a material for the manufacture of belting, hose, packing, and other mechanical purposes has proved a great advantage to the manufacturing interests of this country. Like all new things, it had, at first, to make its way against considerable opposition, and was accepted with caution by manufacturers. When once tried, however, it was soon appreciated, and its use extended from year to year. When the industry first started, its subsequent development was not foreseen by even the most

RUBBER BELTING.

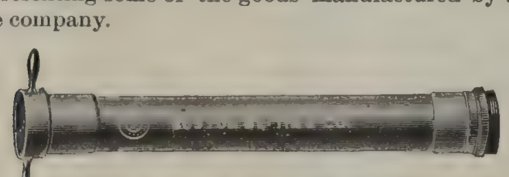
enthusiastic advocates of the new material. One of the earliest firms to embark in the business was the Roxbury Rubber Company, which, nearly sixty years ago, began the manufacture of rubber goods in a comparatively small way, in what was then the town of Roxbury, but which is now a part of the city of Boston. Even at this early date the product of the company included

RUBBER CONDUCTING HOSE.

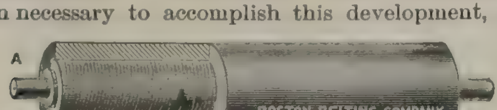
a large variety of goods, though particular attention has always been given to the manufacture of rubber belting for agricultural, railway, and other purposes. The increased demand for goods of this character compelled the company from time to time to enlarge its plant; and though remaining always in its first chosen locality of Roxbury, it has changed its official title to


STEAM PACKING.

the Goodyear Manufacturing Company, and again, when a charter of incorporation was obtained, to its present name, the Boston Belting Company. The great variety of uses to which vulcanized rubber may be put is well shown in the accompanying illustrations representing some of the goods manufactured by this one company.


SUCTION HOSE FOR STEAM FIRE ENGINES.

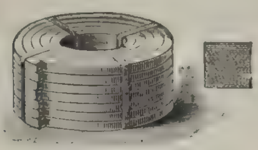
The development of an industry from such small beginnings to one of such magnitude is always a history of interest. In the present case, it has been accomplished by constant experimentation. Much of the machinery has been invented and perfected by the company itself. A large corps of skillful workmen has been necessary to accomplish this development, and

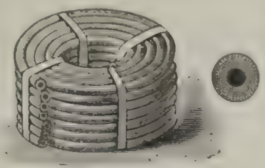


RUBBER COVERED ROLLER.

enable it to produce goods of such varied character. Each year has added a number of articles to the already long list of those which are advantageously made of rubber. This has been particularly the case during the past few years, when so many unique industries are springing up on all sides, and demand accessories of such great variety.

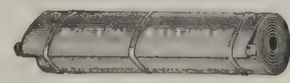
In addition to belting, endless aprons, and blankets for printing and lithographic purposes, deckle straps, hose, gaskets, rubber covered rollers, valves, and tubing, a large number of specialties are manufactured, such as air brake apparatus, tennis soling, carriage springs, washers, diaphragms, dental rubber, and, in fact, so many others that one can hardly ven-


SQUARE PISTON PACKING.

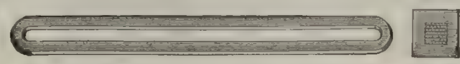

ROUND PISTON PACKING.

ture to continue a list which, to be complete, would include some part of the apparatus of nearly every industry known.

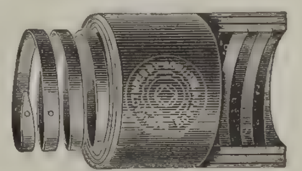
The works of the company are now the largest in the world devoted to the production of rubber goods for mechanical and manufacturing purposes. Their product has gained an enviable reputation for its


ENDLESS BLANKETS AND APRONS.

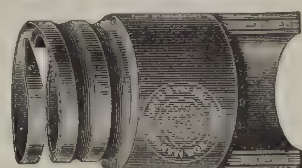
strength, finish, and durability. For machine belting the vulcanized rubber gives a uniformity of width and thickness not possible with leather. It has also the advantage of being uninfluenced by a high heat or intense cold, by dryness or moisture. In addition, its cost is considerably below that of leather. The elevator belts, of rubber and cotton duck, are made


SEAMLESS DECKLE STRAPS FOR PAPER MILLS.

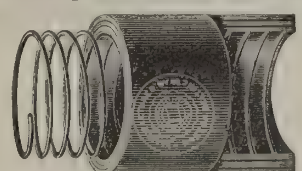
in all sizes from one inch to six feet in width and any desired thickness. They are one of the specialties by which the company is best known. They are stretched by Mr. James B. Forsyth's patent process, and finished with a smooth metallic rubber surface. They are now largely in use in grain and other ele-


SUCTION HOSE ON SPIRAL, FLAT, OR ROUND TINNED STEEL WIRE.

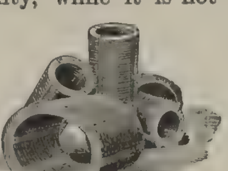
vators and in mills of all kinds. Endless belts, varying in length from 400 to 425 feet, are also made by the same company. Imperial and extra stitched belting is another specialty, which has been manufactured for the past twenty years. In the manufacture of this belting, the plies of coated duck are tho-


PATENT "SMOOTH BORE" RUBBER SUCTION HOSE.

roughly united and stretched. Before putting on the outside or cover, the plies are stitched together with strong cotton cord, the stitches being about an inch apart, and so put in that they cannot wear off. The outside rubber or cover is then put on seamless, so that it cannot open, and the belt is again stretched


SUCTION HOSE ON SPIRAL SPRING BRASS WIRE.

and vulcanized, making a solid and compact body. The endless belts are manufactured in the same way. The manufacture of vulcanized rubber hose for fire, steam, air, suction, and other uses has been greatly improved. As now produced it affords strength, firmness, and flexibility, while it is not affected by or-


GASKETS AND RINGS.

dinary extremes of temperature. It never requires oiling, like leather, and is much less in price.

The rubber used in the Excelsior Fire Hose is the best quality of fine Para, and is carefully washed and thoroughly seasoned before it is used. The duck employed is made of the best quality of long fiber cotton, and is specially manufactured for the purpose. More than ordinary care is required in the manufacture of hose for fire purposes, and a special effort has been made to produce one which will satisfy all the requirements. The Excelsior brand has now been in use both in this country and abroad for many years. In addition to hose made of rubber, with duck insertion, the company manufactures cotton and linen hose, rub-

ELEVATOR BELTS.

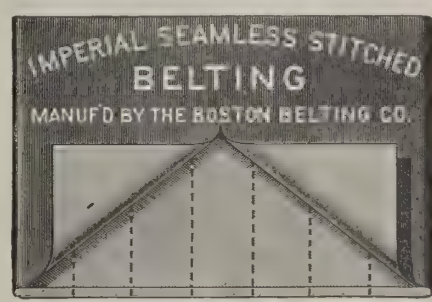
ber lined, now extensively used for fire and other purposes.

The rubber covered rollers, made under Mr. Forsyth's patents, have been largely applied in a great many industrial operations. From their non-corrosive character, they have been used to great advantage in pressing water, dyes, acids, and other reagents from


WIRE-WOUND HOSE.

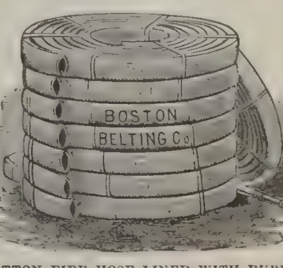
yarns and fabrics. This quality has also made them available in paper and other mills, where it is essential that the materials should pass through the rolls without the least contamination or discoloration.

Under many circumstances it is highly desirable to have a flexible tubing which will be available for suction purposes. Formerly it was necessary to use rigid



SEAMLESS STITCHED BELTING.

tubing, as rubber, unless impracticably thick and hard, would collapse, and be of no use. For this purpose the Boston Belting Company manufacture several tubes which are perfectly flexible, and at the same time capable of withstanding a strong external pressure without altering their cross section. The walls are stiffened and strengthened by a spirally wound flat or round



COTTON FIRE HOSE LINED WITH RUBBER.

tinned steel wire, which is entirely embedded in the rubber, thus giving a perfectly smooth bore, and at the same time preventing any action on the wire by water or other fluids. This also prevents all clogging or displacement by internal pressure when used in connection with hydrants, as is likely to occur to any suction hose not made with smooth bore.

LINEN FIRE HOSE LINED WITH RUBBER.

The works of the Boston Belting Co. are still located in the Roxbury District. The office and store are at 222 to 226 Devonshire Street, Boston, with a branch at 70 Reade St., N. Y. The officers of the company are: Mr. Jas. B. Forsyth, manufacturing agent and general manager; Mr. I. P. T. Edmands, Treasurer; and the Hon. E. S. Converse, President.

Discovery of a New Nebula by Photography.

MM. Paul and Prosper Henry have recently announced the discovery by means of photography of a new nebula in the Pleiades. It was first photographed on November 16 last, and, though it was again photographed on December 8 and 9, MM. Henry have as yet been unable to detect it by direct telescopic observation. The nebula is about 3′ in extent and "tres-intense." It presents a well marked spiral form, and seems just to escape Maia. Its position is as follows: R. A. 3 h. 38 m. 57 s., Decl. 24° 1′ N. The question is sometimes asked, Which is the most sensitive to light—the human eye or the photographic plate? This discovery seems to indicate the superior sensibility of the chemical plate.

DESIGN FOR A SUMMER GARDEN HOUSE.

Our engraving, for which we are indebted to *Architektonische Rundschau*, illustrates a much admired design for a summer refreshment house or casino, by Professor C. Schick, of Karlsruhe.

DESIGN FOR SUMMER HOUSE.—BY PROF. C. SCHICK, KARLSRUHE.

The Origin of Fires.

In speaking of the origin of fires, Dr. Nichols states that present investigations show that the number of fires attributable to incendiarism is much less than is generally supposed. Spontaneous combustion is another cause which has heretofore been brought forward on a great many occasions, when the real trouble has been in defective or careless construction. While dwelling houses in the United States are burning at about the rate of one every hour, and mills, hotels, stores, and barns are vanishing in proportion, it is worth the consideration of every householder to know whether his own premises are inviting destruction from fire, or whether they are reasonably secure from the ruin brought by that element. In the fire tables of 1884, incendiarism is placed at the top of a list of some twenty-seven causes. Next in this fatal list comes defective flues, but it is questionable whether they have been given the rank they deserve. Dr. Nichols mentions as a notable example of the complete carelessness possible in this direction, that the handsome residence of a neighbor got on fire three times within one month, and that on each occasion the narrowly escaped destruction was directly traceable to defective construction. In the first instance, fire was due to wood placed in connection with a steam boiler, and in the other two cases was caused by joists or beams brought in contact with chimneys when the house was built. In these cases sufficient heat reached the timbers to cause ignition.

There are many buildings in all parts of the country to-day where a little hotter fire than usual in furnace or grate will do just the same thing. Every householder should assure himself that no such danger menaces his own home or warehouse. Continued contact of wood with hot brickwork or heated currents of air will eventually cause combustion. There is but one remedy, and that is to remove the conditions. If a building is already erected, and these fire traps carefully concealed, it is a difficult matter to get at the source of danger and see that it is removed; but the difficulty is much less than that of starting anew when fire has carried off the household goods or destroyed the "plant" of a well established industry.

But while spontaneous combustion, being impersonal and therefore without the ability for defense, has had a great many sins laid to its door by builders whose volubility exceeded their carefulness, this peculiar process of slow oxidation has still a heavy account against it in the list of fire losses. In one instance, recalled by the same writer, a dwelling house caught fire by the spontaneous ignition of sawdust placed between kitchen floors as a sound deadener. The sawdust alone was safe enough, but when it became saturated with oil from the polishing of the floor above, new conditions prevailed. The sawdust heated rapidly from the absorption of oxygen by the oil. The temperature speedily rose to such a point that ignition occurred, and flame burst through into the room. For many years the conditions favorable to spontaneous combustion were so imperfectly known that no precautions were taken to avoid them. Now, however, they have been so well illustrated, together with the large possibilities of defectiveness in flues and chimneys, by a very complete list of catastrophes, that an intelligent builder—by which we mean not only the man who builds a house, but the man who has it built as well—must keep this experience in mind, and see that none of these fatal conditions is repeated in his own structure.

With twenty-seven recognized causes of fire, and any number besides, not classified, there are not a few otherwise careful persons who despair of the value of precautions, and trust the whole matter to fate and a heavy insurance. The wisdom of providing funds necessary for rebuilding is certainly commendable; but aside from any economic reasons why valuables should not be permitted to be thus quietly consumed, those who have gone through the ordeal of a fire, at either home or place of business, know that there are many things for the loss of which insurance is but a poor compensation.

Combustion of Copper and Nitrogen.

A curious phenomenon has been observed by M. Blondlot, and communicated to the French Academy of Sciences. A disk of platinum and a disk of copper, 0·03 meter in diameter, were fixed vertically in front of each other by help of two platinum stands. The disks were 3 or 4 millimeters apart, and both were placed inside a bell jar of porcelain, open below. The apparatus was then heated red hot for three hours, by means of a gas furnace, and although there was no electric current it was found that the face of the platinum disk was blackened with a deposit containing copper and platinum. In short, the copper had crossed from the copper plate to the platinum one. M. Blondlot, by repeating the experiment in different gas, found that the nitrogen of the air was the agent in this transport of matter. The nitrogen combines with the copper, and lodges on the platinum, either incorporating itself with the latter or decomposing in contact with it under the influence of its high temperature.

DESIGN FOR A MONUMENT, BY KLOTZ.

One of the most talented and promising of all the sculptors in the Vienna school is E. Klotz. He is distinguished in the study of antiquity, the influence of which is most agreeably shown in his creations. This monument, of which we present a picture, is one of his best works. A task that has often been put before one is satisfactorily solved by simple means, artistically used. First of all the appearance of the monument itself is uncommonly pleasing; from whichever side one views it, the effect is always good. The sorrowful woman's figure shows the greatest animation. One notices a concealed sorrow in the beautiful features of her face, which is turned upward toward heaven. The drapery surrounding her limbs is pleasing in its style. The purely ornamental element of the monument, namely, the urn covered over with palm branches that surround it, harmonizes beautifully with the whole.

The work is the fruit of thorough ability, of an earnest endeavor to reach the highest aim of art by the purest means, and this endeavor will certainly meet with success.

Roofs that are Made to Last.

The idea of making a roof as solid as the ground beneath one's feet—a veritable smoothly paved stone floor—is now exemplified in many of the best examples of recent building in our large cities, where, on account of the high cost of land, business structures are carried to a height until recently unknown.

In this style of construction the T. New patent system of brick and tile roofs has long held a leading place, as is abundantly attested by the long list of notable structures now covered by such roofing. For putting on this roof over iron beams and brick arches, or other fireproof construction, the masonry is first coated with asphaltic roofing cement, on which are solidly cemented four layers of best roofing felt, and then the walls, chimneys, and all openings in the roof are flashed with copper, turning out not less than four inches on the felting, and up against the wall ten inches, or else the copper is let into the joints of the wall.

There are other provisions for gutters and other details, and then the brick or tile is laid in best hydraulic cement, there being here also proper flashings at all side and partition joints. These details are somewhat modified when such roofs are to be used upon a wooden foundation, but there is an equal degree of thoroughness in so making the bed for the laying of the brick or tile, and protecting all joints, that the roof will have the same essential elements of solidity and indestructibility.

The Equitable Life Insurance Building, on Broadway, where the U. S. Government has its signal office for New York city, has for many years had this style of roof, and the company has arranged for putting it on the large extension they are now building. This style of roofing is also used on the New York Stock and Produce Exchange buildings, the Mills Building, the Metropolitan Opera House, the new Potter building (on the site where the SCIENTIFIC AMERICAN formerly had its offices), and in like manner on the most substantial structures in other cities, further particulars in regard to which will be furnished on application to Mr. T. New, No. 32 John Street, New York city.

Switching by Horse Power.

The Berlin Direction of the Prussian State Railroads has found it advantageous to use horses for switching to a very considerable extent instead of engines. At the Moehbein station, near Breslau, there is a system of 19 parallel switching tracks, ranging in length of standing room from 600 to 2,200 ft. These were cross-connected by switch crossings, and 14 of them ran out at the east end into a pull-out-track, and at the west end all connected with a gravity switching track rising from the yard 1 in 100. The switches run over from the gravity track were all operated from one point by levers and at the foot of the gravity track was a signal mast, with arms by which the switch tender could be shown which track was wanted.

DESIGN FOR A MONUMENT. BY KLOTZ.

For serving this yard up to 1881 four switching engines were used, two by day and two at night, which were able to work at breaking up trains from both ends, the western one being helped out by the gravity track, 25 cars being pulled up at once until they cleared the end switch 600 feet, which sufficed to give the necessary speed for setting them in upon the desired track.

This arrangement worked well, but in 1881 an attempt made to handle the business with horses convinced the authorities that they were the cheaper motor, and the work has been done since then with 10 horses by day and 10 by night. Five horses work together in breaking up a train, and single ones do the distribution. No care is taken to run the cars together on the tracks where they belong, this being left to the line engine which is to take them out.

It takes about the same time to switch with horses as with engines, what is lost in speed being gained in saving of travel and of delays caused in communicating between the brakemen and the enginemen.

At this particular station three to five horses are used in local freight switching, which was formerly also done by the switch engines, so that six horses take the place of one engine. The six horses cost \$9.45 per day, including drivers and harness, while an engine, including repairs and train hands, costs \$10.

This apparently does not take into account the interest on the cost of the engines, while the cost of the horse traffic is the actual hire of the animals and of the men employed with them. Further elements favorable to horses which cannot be stated in figures are the less wear and tear of rolling stock, and the saving to rails and switches, by avoiding engines; and also the much safety greater to all employes concerned.

Even if in our large yards, owing to the high cost of labor, horses' switching should not appear profitable, there can be little doubt, says *The Railroad Gazette*, that it would be much more profitable to employ horses at many way stations where a whole train is now held for the local switching necessary, to say nothing of the inconvenience of having business await the arrival of a train, where a horse or two would enable loading and unloading to proceed without break or hindrance.

Oldest Habitations in America.

Major Powell, Chief of the Geological Survey, who has been about a month in the field, has discovered in New Mexico, near California Mountain, what he pronounces to be the oldest human habitation upon the American continent. The mountains in this vicinity are covered with huge beds of lava, in which the prehistoric man and his comrades excavated square rooms, which were lined with a species of plaster made from the lava, and in these rooms were found various evidences of quite an advanced civilization, among them a species of cloth made of woven hair and a large number of pieces of pottery. In the sides of the rooms cupboards and shelves were excavated. In one room, sticking out of the bare face of the wall, was a small branch of a tree. When this was pulled out, it was found that there was a hollow space behind the wall. Colonel J. H. Stephenson, Major Powell's assistant, broke this with a pick and found a little concealed niche, in which was a small carved figure resembling a man done up in a closely woven fabric, which with the touch of the hand turned to dust. It was blackened and crisp, like the mummy cloths of Egypt. In all, some sixty groups of these lava villages were found, there being twenty houses in each group. The evidences of civilization were similar, but removed by their crudity and want of skill a good deal from the articles found in the cliff houses.—*Santa Fe New Mex.*

THE editor of the *Electric World* thinks it would bring disgrace upon the science which his paper espouses by substituting electricity in place of the gallows for executions, which view some papers are beginning again to advocate. By all means, says the electrical editor, let us maintain electricity popular in every respect, and let its death-dealing qualities be the subject rather of cautionary measures than of practical application.

Scientific American.

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CONTENTS

Of the April number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

A COUNTRY RESIDENCE.

BRUCE PRICE, ARCHITECT.

The handsome residence of which we give a colored lithographic illustration with this issue is now in course of erection on a choice spot at Englewood, a favorite locality, in New Jersey, for houses of this kind. The designs are from the pencil of the well known and successful architect, Mr. Bruce Price, of No. 28 West 23d Street, New York city, under whose superintendence the whole of the work is being carried out. The materials used are local stone, with bricks and tiles of a clear red color.

As an effective design in the favorite English domestic style, the drawings we publish will prove useful and suggestive to our readers, while the details of the interior work cannot fail to be of interest. The elevation of the house has many suggestive points. Take, for instance, the block on the right hand of the illustration, consisting of the group formed of the library, drawing and sitting rooms, and we have an elevation almost complete in itself, which would form an excellent basis for the design of the elevation of a smaller house, the treatment of the gable and the general arrangement of the bracketed window being particularly effective. The handsome window in the center of the house, lighting the main hall and staircase, with its substantial transoms and mullions, and treatment of terra-cotta panels on the floor line, forms another interesting and attractive feature.

Coming to the interior of the house, it will be seen that the arrangement of the rooms and general planning have been well considered. The large hall makes an imposing appearance, and the rooms are all of a conveniently large size. In our illustrations a slight difference exists between the plans and the elevation in the position of the bow window in the library. Since the execution of the drawing from which our colored illustration was taken, it was found more convenient to build the bow upon the opposite corner, as shown upon the plan.

The finish of the joinery and trimmings throughout is on a scale to accord with the quiet elegance of the exterior, being all executed in polished oak, richly moulded and carved. The mantels and other details of which we give illustrations are of attractive design, and will form an example of the general finish of the interior.

It is calculated that the cost of the whole of the work, when completed, will amount to about seventy-five thousand dollars.

CONCERNING OURSELVES.

Perhaps our readers will be interested to learn how we are progressing and what is the promise for the future.

The present issue completes the first half year of this special edition of our paper. Its success has surpassed expectations; the new and interesting features presented have been quickly discerned and highly appreciated by the public; as a practical result, we have already attained to a very large circulation—far larger than that of any other publication of the same class; a valuable advertising patronage is secured; and the way opened for much prospective usefulness. Our aim has been to improve upon each successive number. The beautiful illuminated plate of a country house, by Bruce Price, Esq., which forms one of the supplements to this issue, is an example of the advance we are making. It is considered by judges of the printer's art to be one of the finest and most artistic productions of the press. No pains or expense will be spared by us to increase the value of successive numbers, and thus to merit a continuance of the public favor. We have in preparation a large number of elegant plates. Among them, soon to appear, is a large plate in colors representing twelve different designs for country dwellings, each costing about three thousand dollars. These designs are from photographs of buildings actually erected at the above cost. The variety in the styles of the houses and their pleasing appearance as built indicate fidelity and taste on the part of architects and builders, and prove that economy of construction and symmetry of proportion may be successfully conjoined.

It will be to us a gratification and encouragement if our readers will take advantage of appropriate occasions to call the attention of their several friends to our work, and invite them to become regular subscribers. We are at present enabled to supply all the back numbers complete, and thus to date back subscriptions and supply new subscribers with the whole series, colored supplements and plates, at $1.50 a year and 15 cents for single copies. This is by far the most elegant and cheapest publication of the kind ever presented.

DR. PERSIFOR FRAZER, of Philadelphia, has tried composite photography to the testing of signatures. His experiments do not yet insure absolute certainty in discriminating true from forged writing, but it removes the possible bias of an expert's testimony, and allows the photograph to be weighed by the jury and court like any other evidence.

To New Subscribers.

All new subscribers can, if they desire, be supplied with the back numbers of this paper, which extend to November, 1885, when the first number was issued. The subscription price is $1.50 a year.

The November number includes two plates in colors and a sheet of details, illustrating a cottage, by O. P. Hatfield, architect.

The December number includes two plates in colors and a sheet of details, illustrating a cottage, by John E. Baker, architect.

The January number includes a large double plate in colors and sheet of details, illustrating a block of New York city houses, by Lamb & Rich, architects.

The February number includes two plates in colors and a sheet of details, illustrating country stores and dwellings, by Frederick B. White, architect.

The March number includes two plates in colors and a sheet of details, illustrating two different cottages, by John E. Baker, architect.

The April number includes a large plate in colors and a sheet of details, illustrating a large country house, by Bruce Price, architect.

These illuminated plates are executed in the finest style, and their value is far in excess of the subscription price of the paper.

Architect's Level.

The Architect's and Builder's Level manufactured by Messrs. Keuffel & Esser, and described in our March issue, is not, we find, a new departure.

The Messrs. Gurley, of Troy, N. Y., have been manufacturing a very similar instrument, and have had it on the market for the past ten or eleven years. The levels of both makers enjoy such an enviable reputation that, with the price identical, it would hardly be possible for us to claim superiority for either instrument, without unjustly ignoring the merits of the other.

Oil Fuels.

The current year is likely to witness the rapid development of the use of liquid hydrocarbons as fuel—experimental trials having given most encouraging results. I have already referred to liquid fuel in the form of tar, which has been applied in various ways since the introduction of gas lighting; but the liquid fuel of the future will be oil, of which there appears to be an inexhaustible supply. Large as are the oil wells of America, they sink into comparative insignificance compared to the immense reservoirs existing and being opened out in Russia, where springs have been tapped which yield 2,000 to 4,800 tons per diem, and artesian wells spout oil to a height of 200 to 300 feet.

Considered as a fuel, it is, bulk for bulk, superior to the best steam coal, with the advantage of perfect controllability in combustion. Its application to steamship boilers has been an undoubted success; and the system is attracting much attention, and will come to the front. The apparatus for consuming the oil consists of a superheating iron or copper coil placed in the bottom of the furnace, which is covered, after the fire is in full operation, to protect it from too great a heat. The combustion chamber is lined with fire brick, similar to a Siemens regenerative furnace. In starting, the coil being uncovered, a small fire is placed on it, and a slight spray of water is forced into it from a tank. This at once generates steam, and starts the oil fire. The steam from the superheater is made to pass through an annular space between two tubes (similar to a gas blowpipe). The inner one contains the oil, which is thus heated on its passage through the tube before it is caught by the steam and blown into the furnace or combustion chamber. After the steam is raised, the coil can be fed from the boiler.

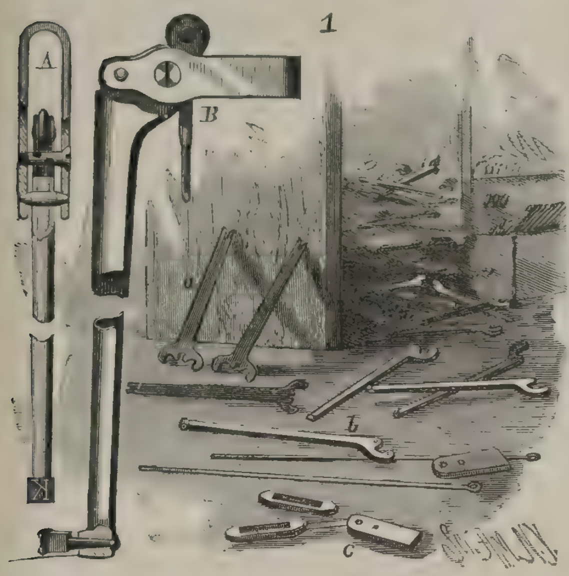
From experiments conducted at Oliver's engineering works, at Chesterfield, the evaporative effects obtained show the efficiency of Scotch shale oil (blue oil) working against Derbyshire coal to be as 2·6 to 1. Messrs. Wigham and Richardson have obtained an evaporation of 15½ lb. of water in a marine boiler; and the engineers of the French Diamond Mining Company report the average result of their experiments made with a "Robey" boiler at Oliver's works as 16·3 lb. of water evaporated to 1 lb. of blue oil—a very high duty indeed.—*C. E. Jones.*

SPEAKING of the rotting of timber, the *Builder* says: "The *Merulius lacrymans* is the common wood fungus that destroys nine-tenths of the wood with which we are acquainted. The reason of it being common to new buildings and not to old is that moisture, one of the constituents of its existence, is more present in new, green buildings than in old, dry, seasoned ones. The two prime conditions of its existence are moisture and heat; if moisture is present without heat, it will not grow, and hence its depredations in the winter time are unknown. If heat is present without moisture, it will not grow, and hence ventilation for the passage of a current or dry air will prove fatal to its existence.

CALIGRAPH WRITING MACHINES.

As late as our Centennial year, writing machines were little used, practically unknown to the great majority of writers, and were held by many who knew something of them to be mechanical toys, rather than the great time and labor savers they have since proved to be.

In fact, the principal development which has made these instruments almost a necessity to writers of the entire world has been made since 1881, when the American Writing Machine Company, of Hartford, Conn., introduced the caligraph.



TYPE BARS.

Up to that time double case writing machines were so constructed as to compel the operator to shift the carriage by a gratuitous stroke for capital letters and figures; the caligraph prints each character in both capitals and small letters at a single finger stroke.

The type bar is one of the most particular parts, as the ease and accuracy with which the machine can be operated depend largely upon the care exercised in its construction. Perfection in this direction seems not to have been reached until the new patented hollow type bar (having an adjustable cone shaped bearing to take up wear) was brought out by this company.

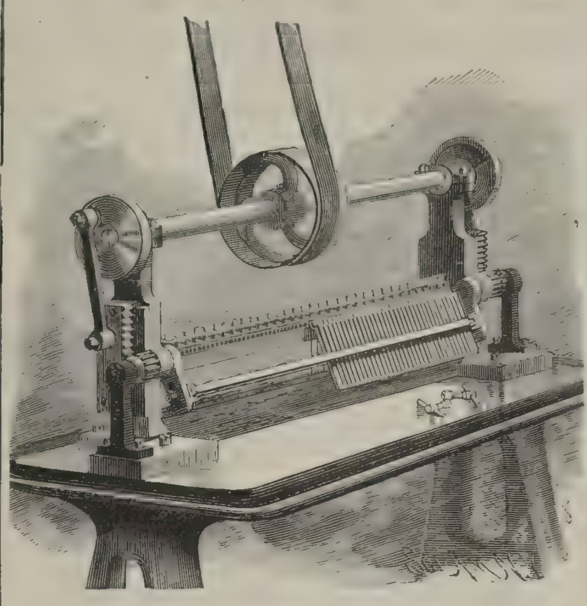
This bar is constructed of cold rolled steel, and is stamped and folded, as shown in Fig. 1. In each end is inserted a piece of steel, which is brazed in—see Fig. 2. The cone shaped bearing is a pivot of Stubs' steel wire made perfectly to gauge, by special machinery, casehardened and polished. After being adjusted in the hanger bearing they are secured in a working machine, and run for three-quarters of an hour, or until the bearings are perfect.

The operation and construction of this machine is shown in Fig. 3.

BRAZING TYPE BARS.

The hanger or bearing for the type bar is made to fit the casehardened pivot, and the top and bottom milled to insure being rigidly held in position on the top of the frame or disk. This hanger also has an adjusting screw to take up the wear, as shown in Fig. 1.

To insure a perfect imprint, the type must strike on a flat surface, and to accomplish this a platen (or printing cylinder) has been invented, having a polygonal shape, which presents flat surfaces for the full length of the lines. The platen of rubber is driven across the top of the machine, on casehardened and ground steel rods, driven by a spiral spring beneath, applied in such a way that it unwinds but one-seventh of a turn in driving the platen across the disk, thus making the tension on the carriage practically the same at all points.



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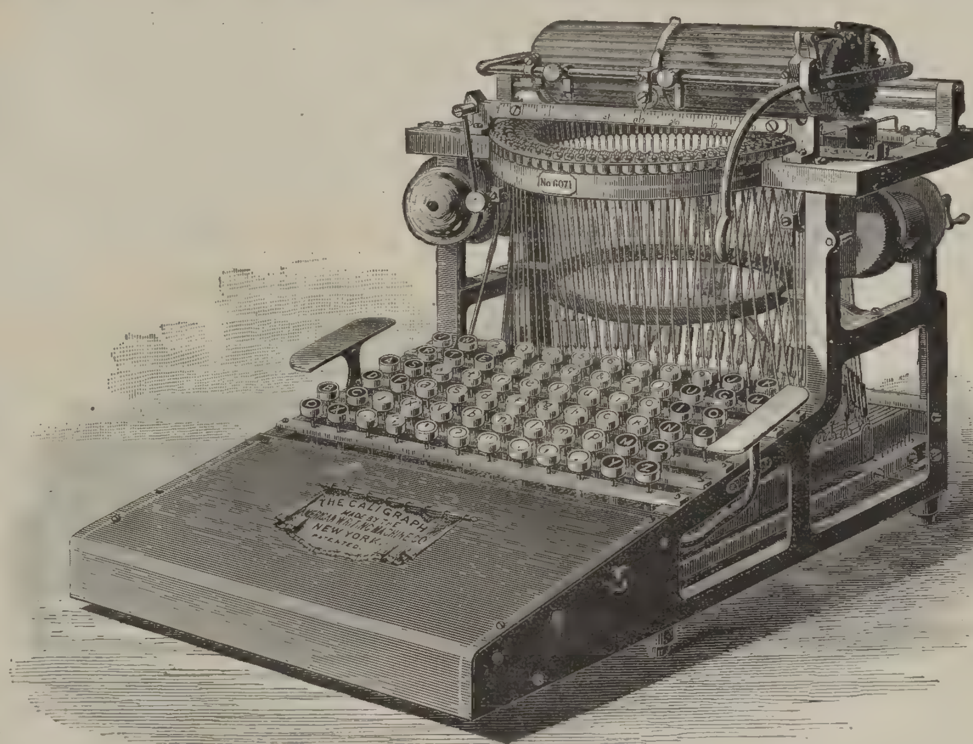
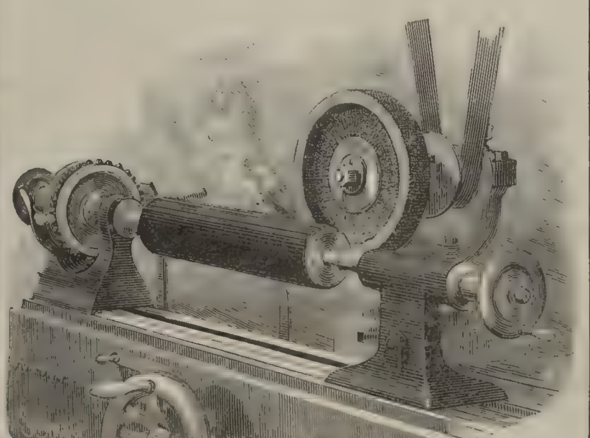


The Caligraph.

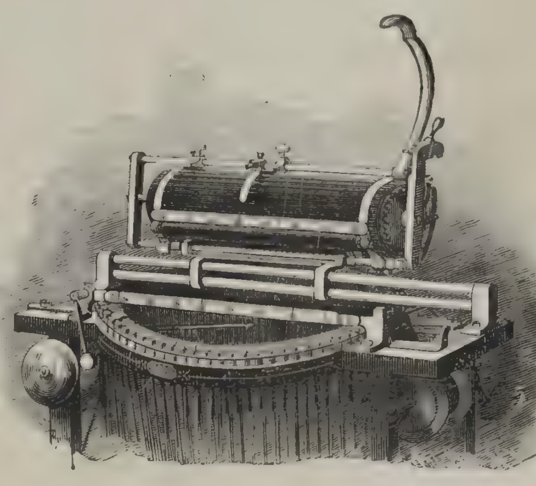


GRINDING PRINTING CYLINDERS.

We illustrate—see Fig. 4—the operation of the machine that automatically grinds these faces on the round hard-rubber cylinder.

To give a better understanding of the arrangement of these faces, and how they appear in the machine, we show the top of the caligraph with its carriage tilted back—Fig. 5—bringing to view the surface presented to the type.

The works of this company are fitted up to construct the machine out of the raw material, and many other interesting processes might have been illustrated. The American plan of interchangeable parts has been fully carried out, milling, grinding, automatic, and special machinery being extensively used.



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Among other advantages of the caligraph, it writes a longer line and receives wider paper than any other writing machine, and is made in several sizes, some particularly adapted to the work of insurance companies and architects. A variety of types is offered, and machines are shown for writing Spanish, Russian, German, and other modern languages.

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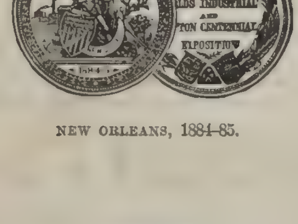
Our limited space prevents us from noticing here the many splendid testimonials now in possession of the company, relating to the practical excellence of this remarkable machine.



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A Country House

BRUCE PRICE, Architect, New York.

SCHUMACHER & ETTLINGER, NEW YORK

Finishing and Filling Wood.

Many inquiries concerning the best method of finishing hard wood in its natural state have led us to publish the following on same. The process used by many in finely finishing hard woods has been slow and expensive. Through a discovery made some years ago, the patent for which is owned by the Bridgeport Wood Finishing Company, of New Milford, Conn., both time and expense in finishing hard wood in its natural beauty have been saved.

The advantage of this new process is that by one application of the article in the manner directed, a smooth and perfectly transparent surface is at once obtained, upon which one or two coats of varnish will accomplish more than was attained by the old process with five coats of varnish, and more in some cases.

The correct principle of finishing all kinds of wood is to produce a perfectly smooth and elastic surface with as little labor and expense as possible. To accomplish this, the pores of the wood must be filled with an unchangeable substance. When this is done, one or two coats of varnish will give the most desirable and durable finish attainable—of course, the better the varnish, the more durable the finish. This new preparation for preparing the surface of wood for varnishing and finishing is known and sold upon the market as the Wheeler patent wood filler.

This filler, in a few years, has attained almost a world-wide reputation, which has led parties to imitate the article in appearance, and, in some instances, they have copied the labels of the Bridgeport Wood Finishing Company almost *verbatim*. As the article is patented, it is impossible for any one to make or sell same without being liable to damages for infringement. Unscrupulous manufacturers have overcome the difficulty by grinding into a mass such materials as starch, whiting, plaster Paris, barytes, etc., all of which, more than twenty years ago, were tried for the same purpose, and after repeated tests condemned; in many cases doing thousands of dollars damage to manufacturers who used them. The legality of the patent owned by the Bridgeport Wood Finishing Company, we would state, has been sustained in a decision by his Honor Judge Shipman, on final hearing in the Circuit Court of the United States. The decision in substance was as follows: The liabilities of an infringer are incurred by using ground silex, quartz, flint, or feldspar in filling wood.

Many manufacturers of poorly ground silex are canvassing the country, and inducing parties to buy dry silex from them and make their own filler. We would, however, caution consumers and manufacturers not to use it for filling wood, as they would lay themselves open to a suit for infringement.

The company publishes a pamphlet on finishing hard wood, which would be useful to any one needing information on this subject. This pamphlet can be obtained free by addressing them. Out of a list of more than three hundred names of prominent manufacturers which they submit to us, we have selected the following, who have used the Wheeler filler to their entire satisfaction for a number of years: Pottier & Stymus Manufacturing Company, manufacturers of fine furniture, New York; George Steck & Co., piano manufacturers, New York; Pullman Palace Car Company; Wheeler and Wilson Manufacturing Company, Bridgeport, Conn.; Singer Manufacturing Company, South Bend, Ind.; Estey Organ Company, Brattleboro, Vt.; Mason & Hamlin Organ Company; Chickering & Sons; and the Herring Safe Company.

DESIGN FOR MEMORIAL WINDOW
BY ALFRED PILGRIM

MUSIC ROOM WINDOW
BY ALFRED PILGRIM

IMPROVEMENT IN STAINED GLASS MANUFACTURE.

Among the many combinations of the decorator's art to enhance the beauty of modern interiors, the revival of the use of painted and stained glass has been the dominant feature wherever success has been most achieved.

We now direct the special attention of architects, builders, and others who are erecting buildings to an entirely new process for making stained glass windows, which has carried this beautiful art so far in advance of all previous methods of manufacture that it may be said that perfection has at length been reached.

We refer to the work of the Belcher Mosaic Glass Company, of Newark, N. J., whose show rooms are situated at 123 Fifth Avenue, New York. Here specimens can be inspected, and we trust that those interested will avail themselves of the opportunity, as it is barely possible to do justice to these beautiful works of art in any written description we may offer.

As works of art, the product of the Belcher Mosaic Glass Co. commends itself to the lover of the perfect and beautiful. Take for instance the design for a music room here shown, which is a combination of stained and painted glass, and it will be observed there is an air of refinement and delicacy of finish throughout. The coarse, heavy lines of metal which usually obscure light and break up the unity of the design are wholly absent. It is, as it were, a lovely mosaic built up of pieces of glass of infinite minuteness, which reflect their colored lights with the brilliancy of jewels, yet the shading and mellow tones are perfect. The beauty of this invention lies in the fact that the artist has full control over his work throughout, which reflects his artistic feeling and skill as perfectly as if he had performed the work with a brush. This of course could never be said of any form of stained or painted glass hitherto produced.

There is also a commercial side to this question, which is important. The process of the Belcher Mosaic Glass Company is very simple and labor-saving, and permits a great economy in the cost of production.

The company give the public the benefit of this economy, and most beautiful memorial windows can be obtained from them at a price considerably less than hitherto charged for work of equal artistic beauty. This feature has largely contributed to the work of this company being introduced into private dwellings. For such purposes, charming panels can be obtained as low as seventy-five cents to a dollar a square foot.

We recently saw a series of charming memorial windows prepared for a Roman Catholic church, and we understand that the work of the Belcher Co. is preferred to all other stained glass for ecclesiastical buildings.

Those who desire more detailed particulars and estimates for stained glass work should address the Belcher Mosaic Glass Company, 123 Fifth Avenue, New York.

Earth as a Purifier.

Nothing will purify and keep a stable so free from odors as the free use of dry earth, and every one keeping horses or cattle will find it pays to keep a heap of it at hand, to be used daily. A few shovelfuls of earth scattered over the floor after cleaning will render the air of the apartments pure and wholesome. The value of the season's manure pile may be largely increased by the free use of such absorbents. The strength of the gases and liquids absorbed is retained, and is the very essence of good manure.

THE BRUSSELS NATIONAL EXHIBITION.

There were great festivities, in 1880, in Belgium to commemorate the jubilee of Belgian independence, it being just fifty years since the good citizens of Brussels raised the standard of revolt against Holland, and driving Prince Frederic, the king's son, who commanded the troops, from the city, declared their country independent, and elected a provisional government. The festivities were inaugurated on the 15th of June, by the opening by the king and queen of a grand National Exhibition, a handsome structure which has been built on the Champs des Manœuvres, and which contains chiefly exhibits of what Belgium and the Belgians have produced, either in the way of manufactures or of inventions or of art, since 1830. The *façade* of the building, as may be seen in our sketch, chiefly consists of two pavilions, united by a semicircular colonnade, in the center of which stands a triumphal arch. In these pavilions, among other things, will be found a curious exhibition of specimens of the manufactures and art products of bygone ages—such as jewelry, furniture, costumes, porcelain, carpets, armor, coins, etc., all of which will be curious and interesting to compare with similar articles of the present day. Foremost among modern exhibits are objects relating to education, and in those at least we moderns may boast of having achieved a vast improvement. Behind the pavilions

THE JUBILEE OF BELGIAN INDEPENDENCE.—THE NATIONAL EXHIBITION BUILDING AT BRUSSELS.

and the arcade are numerous temporary buildings containing exhibits and collections of various kinds, ranging from leather and pottery to railway carriages and fruits and vegetables. The applications for space have been great, and there are no fewer than seven thousand exhibitors. The gardens are very prettily laid out, and, together with the buildings, occupy an area of some seventy thousand square meters. The cost of the Exhibition is estimated at £48,000. Our sketch is a reduction from the original plan of M. Bordiaux, the architect.—*London Graphic.*

RAWDON HOUSE, HODDESDEN, ETC.

Among the architectural exhibits this year at the Royal Academy are the four drawings given opposite, by Ernest George and Peto, Argyle Street, W. Rawdon House, Hoddesden, is an interesting old building, bearing the date 1622; to this the architects have been adding a wing for Mr. Henry Ricardo, the owner. The choice of material had to be made in adding to a building that had been ruthlessly stuccoed. On peeling off the cement from the old work, interesting brick mouldings and pilasters were exposed; and great care has since been taken in bringing again to light the red-brick walls which fixed the character of the new work. The house stands back some seventy feet from the high road. It was decided to add the additional rooms in a wing between the house and the road, forming a courtyard in front, with a gateway to the stables, and covering the site of a recent badly-built extension, which was out of character with the old house. The new wing contains a dining room, schoolroom, nurseries, and bedrooms, and a lift from the offices, and other such conveniences, of which the old house was innocent. The billiard room is oak paneled, after the manner of the original rooms. A sundial makes a pleasing feature on the south front of the new wing, and the new and old work blend harmoniously. The new building and works to old front have been very satisfactorily carried out by Mr. Hunt, of Hoddesden, at a cost of between four and five thousand pounds. Mr. J. B. Gass, of Bolton, has had charge of the works, and has shown great care in their superintendence.

A house at Westgate-on-Sea is another work by the same architects, and is now erecting for Mr. Herbert Peto. The house is situated with a fine view of the cliffs and sea, in one of the healthiest positions of this healthiest of seaside places. The plan is compact and square, though the squareness is lost on the ground floor by the large bay windows toward the sea, and the roof is rendered interesting with picturesque gables. The rooms are grouped around a paneled hall, with a fireplace and deeply recessed windows. The dining room has an ingle nook, lined inside with gauged brickwork, and has settles on either side. The long range of windows at the top light a good playroom and schoolroom for the children. The stables are at a short distance from the house. The buildings are of red brick, with weather tiling, and the gables are filled in with plaster modeling by Mr Walter Smith, of Lambeth; the brickwork is built in cement, and the external walls are hollow, with Jennings' borders, as no solid wall would keep out the sea-damp. The house is being erected by Messrs. Peto Brothers, at a cost of about three thousand pounds.

Woodhouse, for Sir George Baker, Bart., is now building at Uplyme, Devon, near Lyme Regis. It is beautifully placed on rising ground, in one of the loveliest coombes of this part of Devonshire, with a fine view over the Lyme Bay, and is situated near Rousdon, a large work just completed for Sir Henry Peek by the same architects. The ground story of the building is of random-coursed Uplyme stone, built hollow, with brick lining. The upper portion of the building is of timber, boarded and felted over and covered with weather tiling. The gables are of oak timber work. The contract was taken in competition by Mr. Luscombe, of Exeter, for the sum of four thousand five hundred and twenty-five pounds.

The Lodge, near Pinner, for Mr. Lawrence Baker, is built on the site of the former one that was frequently inundated by the rising of the Pinn. The present lodge is built upon arches, under which the water may rise without doing mischief. The posts of the porch have been cleverly carved by Mr. Hitch. The ornamental plaster filling-in of the timber work is from the hands of Walter Smith. This lodge, and the group of three cottages, have been built by Mr. J. Kindell, of Harrow.—*Building News.*

HOUSE DRAINAGE.*

Wherever the water-carriage system is used for removal of excreta, it is very desirable that sewers should also be provided. But as many suburban communities may not yet have provided sewers, and many good houses are frequently being built in isolated places where sewers cannot be expected to be constructed for a long time, it becomes important to consider the best substitute for sewers in such cases. The ordinary way is to dig a hole in the ground and line it with loose stone or honeycomb brickwork, into which the sewage may be led, and from which it is hoped it may soak away into the soil and be out of sight. Where the soil is very porous and the surface sloping away from the house, this method may succeed for some months, and even years, without much risk to the house, *provided* this cesspool is far enough from the house to prevent its odors from being carried back through the air, and provided pains be taken that the gases evolved by the decomposition always going on within the cesspool shall not be conducted back into the house through the drain pipe.

But this method can never be satisfactory. The great risk of all such contrivances is the contamination of the soil and the drinking water, where this is drawn from wells or cisterns on the same premises. Dr. C. F. Folsom, Secretary of the Massachusetts Board of Health, relates in the *Medical and Surgical Journal* for March, 1880, that a well which he tested was proved beyond a doubt to be contaminated by a privy vault one hundred feet distant, the well being sixteen feet deep. There was no unusual taste in the water, but suspicion had been directed to it from typhoid fever among those who drank its water. It follows, then, that all porous cesspools must be condemned. They store up the filth in the soil just deep enough below the surface to be out of sight, and out of the reach of the absorbent powers of grass roots, while even when ventilated they do not give access to a sufficient quantity of air in contact with the decaying mass of organic matter to insure its decomposition. The soil close about them soon becomes saturated with a vile compound, filling its pores by degrees, and finally refusing to carry off even the water, except during the driest part of the year. Such contamination of the soil in the neighborhood of dwelling houses is, under all circumstances, to be avoided. Cesspools should therefore be made tight by brick floors and walls, laid in hydraulic cement and plastered with as much care as if they were to act as rain-water cisterns. What then is to be done with their contents when filled? The best way in theory, doubtless, is to use it for fertilizing the soil. This may be done by pumping and carting where there is not enough land near the house suitable for its absorption. It can be distributed on the land by gravity where there happens to be land low enough, though small house lots seldom give this opportunity. In accomplishing this where there is land adapted to the purpose, an *intermittent* flow is desirable, both for the sake of flushing the pipes and avoiding deposits within them, and to allow the air an opportunity to follow the sewage as it soaks down into the pores of the soil. The air, thus admitted alternately with the fluids in the finely-divided pores, serves to oxidize a large portion of the organic matter—to burn it up, as it were, and form such new compounds as to favor its more ready appropriation by vegetable life. This intermittent flow has been attained with some degree of success by Field's flush tank. So far as its flushing power goes it leaves little to be desired, but it is doubtful whether there is time enough left between its periodic discharges, ordinarily, to allow of much oxidation in the pores of the soil; for this process is a slow one, and must necessarily require a good deal of time where the quantity of sewage is considerable.

Mr. Rogers Field has introduced this process in England, and Col. Geo. E. Waring, Jr., has introduced it in this country and applied it for this purpose with some success. He distributes the sewage from the flush-tank below the surface, in porous drain-pipes with loose joints laid less than twelve inches under the surface. The end sought is to fill the whole system of these pipes with each discharge from the tank, and the sewage is to soak away from the joints of the pipes while the tank is being refilled. In some places this plan has worked well, while in others the joints of the pipe or the pores of the soil, or both, have apparently become choked with the solid particles held in suspension by the sewage, to such a degree that the absorbing power of the soil around the pipes has become impaired. The result is that the sewage bursts up to the surface and becomes a nuisance near the lower end of the system of distributing pipes. This fault can perhaps be remedied or avoided by a thorough underdraining of the soil and by taking proper pains in laying the drains and providing sufficient surface of land for absorbing a given amount of the sewage. Different localities and different soils give very different results, and it becomes very largely a question of judgment in matters of detail, to adjust the parts of this system so that it will work without further annoyance. It seems to be yet a matter of doubt, however, whether the distributing drains will remain *permanently* porous in any particular case where the quantity of sewage is considerable. The weak point in the system seems to be that certain portions of the pipes and the surrounding soil become so lined with the solid particles of the sewage that the pores are closed by degrees. This capacity for continued absorption will, however, depend very much on the physical character of the soil and the perfection of its under-drainage. The water must, of course, be given a free path to escape from below the pipes that distribute the sewage, either by selecting a locality with a subsoil that is always dry and loose, or by rendering it so by deep drainage. A perfect uniformity of condition in the porosity of the soil throughout the whole system of distributing-pipes is hardly possible to be attained. It follows that when the less porous places begin to clog, a larger duty is imposed upon the remaining portion, till sometimes the greater part seems to become obstructed. The only remedy is to dig out the pipes and clean them, and the frequency of this operation can only be determined by actual trial.

In all cases where a distribution of sewage is made on the surface or underground, a thorough under-drainage is absolutely necessary. Any locality where this cannot be attained within reasonable limits as to cost is therefore quite unfit for this method.

Distribution of the sewage on the surface, though requiring more attention at stated times than the method just described, is sometimes made use of with success, even on the small scale of one or more houses. I have myself a house occupied for three or four months of the hottest part of the year, managed thus. (See Fig. 5, page 179.) A tight cesspool is made in the ground, about one hundred feet from the house, of a capacity sufficient to hold about one week's

* From a lecture by Mr. Edward S. Philbrick, C.E., delivered before the students of the Massachusetts Institute of Technology.

accumulation of sewage. When filled, this fact is indicated by an overflow discharging on the surface behind the stable, which pipe also serves as an air vent. A trench was dug from the bottom of the cesspool, about one hundred and fifty feet long, with its bottom graded so as to drain the cesspool on the surface of the ground in this distance. A four-inch stone-ware drain pipe was laid and buried in this trench. Just below the point where this pipe passes through the wall of the cesspool, a common four-inch brass-faced water stop-gate was set in the pipe, C, with a four-inch pipe set upright from its top to the surface of the ground, through which a wrench or gate key can be inserted, to open and close the gate. By opening the gate, the whole contents of the cesspool are by this means discharged at will on the surface at the lower end of this pipe in five to ten minutes. At this point of discharge lies a plat of land used as a kitchen garden. While the sewage is flowing, a man with a hoe guides it here and there between the rows of peas and corn, so as to secure a tolerably uniform irrigation. The soil is light and sandy, and absorbs the whole in half an hour. By choosing for this process a time when the wind

FIG. 5.

blows from the house to the garden, no inconvenience results, and the garden shows the benefit of this application of liquid manure. If this place were to be used during the whole year, it would require more breadth of land and a greater distance from the house to avoid offense. But under the existing circumstances, where the character of soil and the slope of the surface, and direction of prevailing winds, all combine to favor this method, it has proved very satisfactory, and might be equally so if applied to a combination of houses. If the drain were allowed to discharge continually, directly from the house to the garden, it would flow as a driblet and accumulate a mass of filth at the point of discharge that would become a nuisance. The amount of attention required in this case is trifling, being only about ten minutes once a week, which is well repaid by the benefit to the crops.

The apparatus is all durable, and not likely to get out of repair. Its application without the labor of pumping is of course limited to those places where a sufficient slope of the ground exists to allow the bottom of the cesspool to be drained on to the surface of the ground within a reasonable distance. If no such slope exists, the labor of pumping by hand might be serious, and would, in case of a combination of several houses, justify the erection of a windmill or horse power pump. If the houses were supplied by water under pressure, a larger quantity would probably be used than if it were all pumped, so that the size of the cesspool would either be increased, or the periods of emptying be made more frequent, all of which items must vary considerably with local circumstances and the wants of the families concerned.

Whenever cesspools of any kind are used, especial care must be taken to break the continuity of the drain between them and the house. The most efficient way to accomplish this in a climate where the winters are as severe as with us, is to have a running trap in the drain, of similar section with the drain itself, round and smooth, and to open the drain to the air on the side of the trap toward the house. (See Fig. 6.) As it is desirable to have this trap accessible,

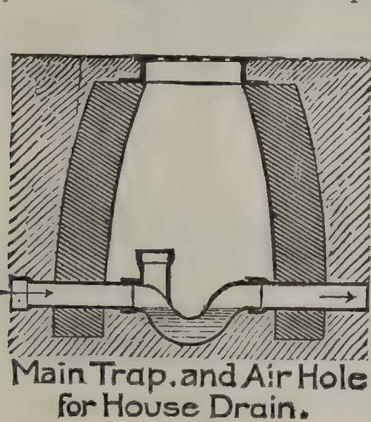


FIG. 6.

it is usually walled around up to the surface with a cover like that of a coal scuttle at the top. In order to admit the air freely this cover should be perforated with holes. When sewers are provided, some writers on the subject favor the omission of this trap on the main drain, on the ground that it obstructs the continuous flow of the sewage, and that the air of sewers, when properly constructed and ventilated, is not likely to be so bad as that of the house drains. But I prefer the outside air to either, and do not regard the slight delay of drainage in passing through this one trap as of much consequence. If it is so constructed as to have no square corners for accumulation of deposits, and if all the drainage of the house flows through it, nothing can stay there long. But this trap should never be applied without the air hole as described above.

The material generally used for drains outside the house walls is glazed stoneware. It is a good material for the purpose when well made. It is furnished in lengths of two or three feet, with special forms for branches and bends. The defects to be avoided in using it are chiefly distorted forms, easily detected by the eye. It should be put together with hydraulic cement, care being taken to keep the joints concentric. Some people recommend hemp gaskets, to be used to hold the adjacent pieces concentric; but unless more length of socket is provided than in the forms now made, there is not much to be gained by using the gasket. Care should be taken to provide a continuous support for the pipe between the sockets by bedding it in cement for the whole length, unless good packing gravel is at hand which can be rammed in on either side. If this is not done, the weight of the filling is likely to break the pipe, particularly the smaller sizes. Care should also be taken to wipe out the surplus cement that is likely to project on the inside. If this is not done, solid rings of cement will be thus formed, that will dam up the sewage and entirely stop the pipe.

In laying pipes that are too small to allow a man's arm to work inside, say nine inches and smaller, this wiping the inside joint must be done with a swab held by a ratan, about a foot longer than the joint of pipe, kept in the last piece laid down and drawn through every joint after the cement is applied. In making connections between drains all rectangular junctions called T-branches should be avoided, except on vertical lines. The joints known as Y-branches are the only ones fit to be used on horizontal lines. (See Fig. 7.) The use of rectangular connections is sure to be followed by deposits, through the eddy caused by the conflict of currents, as explained in the case of sewers.

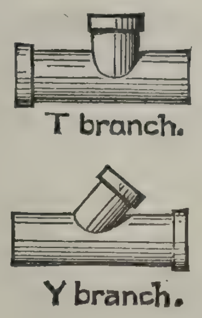


FIG. 7.

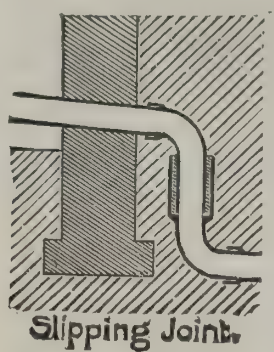


FIG. 8.

A most important matter in laying drains is the character of the foundation on which they are laid. If upon filled land, it is liable to settlement, and since the stoneware pipe, jointed with cement, is perfectly rigid, the least settlement breaks it somewhere, and leakage occurs. The buildings generally rest upon piles in such places, and the drain being therefore on a rigid foundation where it leaves the house wall, is sheared off near this point by the settling of the material outside the wall in which it rests. The substitution of iron pipe for the stoneware between the house and sewer does not remedy the trouble, for even iron would be broken under such circumstances. Where there is a foot or two of fall to be spared, the trouble may be remedied by making a step downward in the drain just outside the house walls (see Fig. 8), making a vertical joint with a long lap and packing it with elastic cement; but this extra fall can hardly be provided in Boston upon the filled lands, without getting below tidewater, at least not until the new system of drainage shall come into use, through the intercepting sewer now in progress. The weak point being just outside of the house walls, can generally be made accessible in the same man hole which serves for access to the main trap and air hole; so that breakage can be detected and repaired without great cost, and, if inspected frequently, without incurring the risk of saturating the soil with filth in contact with the the cellar walls, as is often done by such leakage. I have seen it in some cases penetrating through stone foundation walls and up through concreted floors from the saturated soil outside. It is next to impossible to shut such filth out of the cellars after the soil once becomes thus polluted, for it is both fluid and gaseous, and penetrates the minutest pores. Even where the soil is firm, drains are often found to be broken just outside the cellar walls if they are laid above the bottom of the cellar excavation, as is sometimes done, owing to the loose condition of the soil that is filled under them at this point, where recently excavated. This can be corrected by puddling the filled material under the drain by water, and waiting a week or two after such puddling before laying the drain. It should be remembered that drains when once laid and buried are out of sight and out of mind. A slight defect through poor workmanship can only be detected after some months, perhaps years, during which time soil may have got polluted to an incurable degree. It therefore becomes of the first importance to see that the drains are laid in a permanent and workmanlike manner at first, otherwise the pollution may go on till the house is rendered untenable, which would otherwise have been healthful.

The size and inclination of house drains are important matters, to be settled by proper principles. Where but little rain water is to be provided for, a four-inch pipe is large enough for any ordinary house drain, whether outside or inside the walls. But it is generally desirable to take into the drain the rain water from at least one half the house roof, for the sake of flushing the outside trap. Moreover, the stoneware pipe when as small as four inches in diameter is too imperfect in shape to make a continuous smooth conduit, without slight offsets at the joints that interfere with the flow. So it is generally conceded that private houses should have at least six-inch drains when made of stoneware and receiving some rain water from the roof. This size is large enough for the sewage of a household of fifty persons or more, unless the rainfall from more extended roof surfaces is to be provided for. In this case the size of the drain is to be governed, first, by its inclination, which is generally limited by local topography, and, second, by the size of the roof to be drained. In our climate, a rainfall of one inch and a half per hour from the roof surface should be provided for, adjusting the size of the drain to carry this rainfall. In such cases the sewage can be practically ignored, for its volume is insignificant in comparison with the rain water. The problem becomes then a question in hydraulics, and reference must be had to the governing elements and well-known physical laws, from which we compute the required size. In order to make drains self-cleansing, their contents should have a velocity of at least two and a half or three feet per second. To attain this in a six-inch pipe a slope of one and a half per cent. is required, when the drain is running half full, and it seldom is filled above that point. If this rate of slope cannot be attained, some provision must be made for frequent flushing to avoid deposits, for it must not be forgotten that the cardinal rule in drainage is to *keep everything moving*, and allow no sediment to remain in the pipes. Drains are often made of unnecessary size. This is a more serious defect than would at first appear, for increase of size beyond what is required for carrying capacity is an actual injury, by diminishing the scouring power of the current. It cannot be expected that the interior of our drains and sewers should be so clean as to be entirely free of the gases of decomposing matter, but it is very desirable to reduce their volume to a minimum, and then apply all possible precautions to prevent their mixing with the air we breathe.

The large increase of the quantity of water used in our houses at the present day, compared with that used by former generations, is justly regarded as a most valuable agent for raising the standard of cleanliness among the poor and for contributing to the comfort and luxury of the wealthier classes. But it must not be forgotten that the use of water in this way brings with it an increase of risk if not properly got rid of. The more water we use to dilute our sewage, the further it will penetrate through the pores of the soil, unless securely led off in proper channels, to proper places.

AMERICAN SILK MANUFACTURE.

IN 1810 Rodney and Horatio Hanks started the first silk mill in America, in the town of Mansfield, Conn., for the making of sewing silk and twist. It was not a pretentious affair, being only twelve feet square, and its machinery was doubtless rather crude, for the proprietors made it themselves, according to their ideas of the adaptability of means to ends. With varying fortunes the Hanks family stuck to the enterprise for several years, but finally gave it up. Then Wm. H. Horstmann, of Cassel, Germany, in 1815, established in Philadelphia a manufactory of trimmings, wholly or partly silk, to which were subsequently added ribbons, plaited and braided goods, fringes, sashes, etc. As early as 1824 he introduced in his works the Jacquard loom, and thirteen years later power looms invented by its son, Wm. J. Horstmann. That old concern is still in existence, has the largest mills in the country engaged in its especial line of work, and stands at the head of the long list of manufacturers now engaged in the production of its class of goods. In 1827–8 the Mansfield (Conn.) Silk Company started a mill, but, through an erroneous idea that they could profitably raise their own cocoons instead of importing the raw silk, failed, in 1839, after the expenditure of a large capital, but with the satisfaction to those concerned of having practically demonstrated that silk manufacture here could be successfully prosecuted, if unhampered by unwise attempts at silk culture. It does not seem necessary or even desirable to recount, in this connection, the very long list of silk manufacturing enterprizes that then sprang up here and there over the country, and with varying fortunes—generally rather adverse, however—kept the industry alive and gradually growing. Some of those enterprises are still flourishing, and have, in these later years of prosperity, grown strong and great. Many more failed early, but the failures did not deter, but on the contrary, rather seemed to excite to emulation other sanguine experimenters. As almost the entire amount of raw silk used by these factories was imported, owing to the impossibility of getting American silk properly reeled, the importations of that crude material might well be taken as at least an approximate indication of the vicissitudes of silk manufacture in its earlier years in this country, due allowance being made for other influences affecting importation. Reviewing these, we find that the dutiable imports in different years varied thus:

1824	$1,254	1830	$119,074
1825	8,090	1831	134,376
1826	192,496	1832	48,938
1827	135,230	1833	135,348
1828	608,738	1834	139,256
1829	101,796	1835	10,715

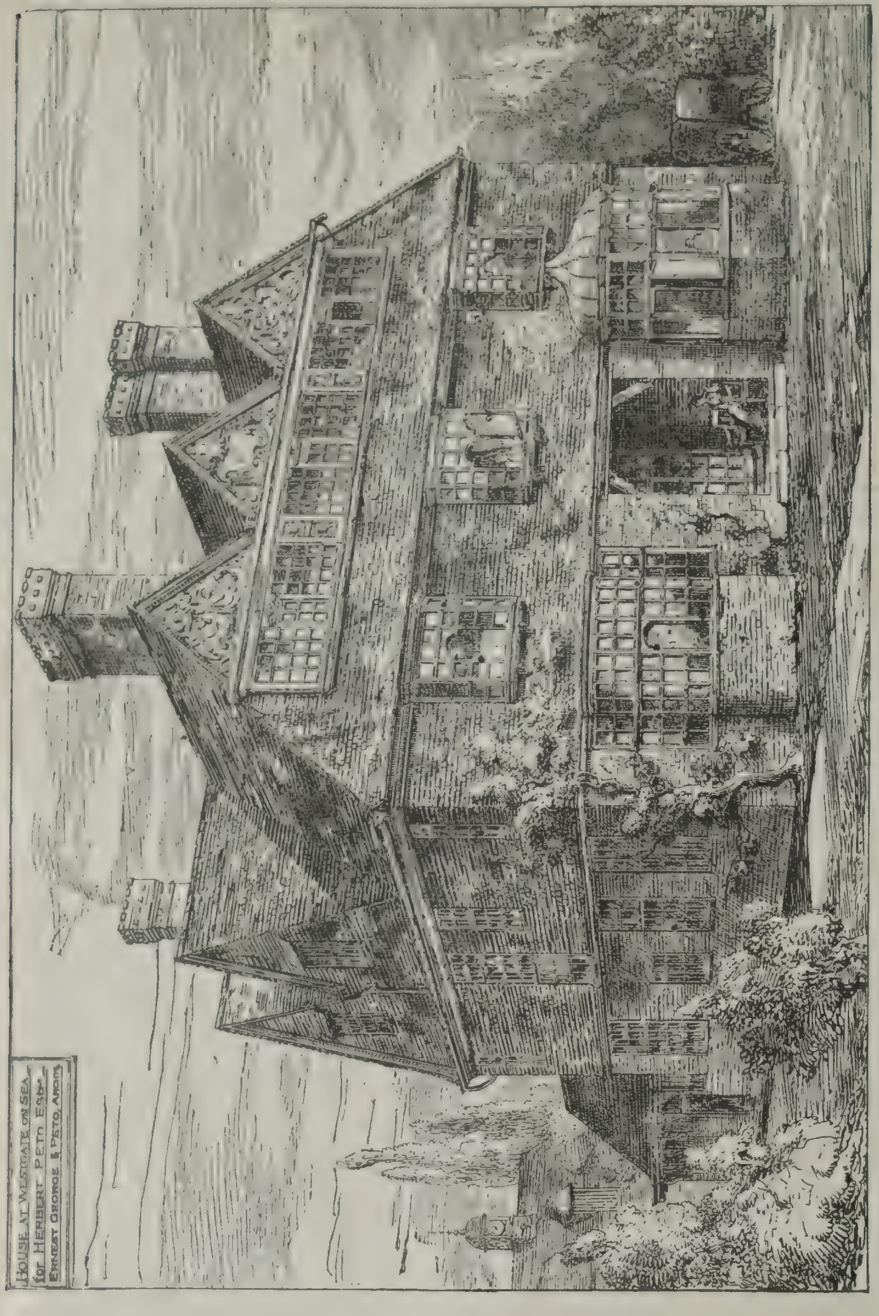
Not until 1853 did the importation of raw silk reach the extraordinary amount of 1828, but in that year it amounted to $712,092, and in the succeeding year (1854) to $1,085,261, and in only one year since (1862) did it fall below, amounting to only $489,516. In 1858 the duty was taken off raw silk—with the exception of ten per cent. levied on that imported via the Cape of Good Hope, which was maintained until 1866. From that time the imports of raw silk have been in value as follows:

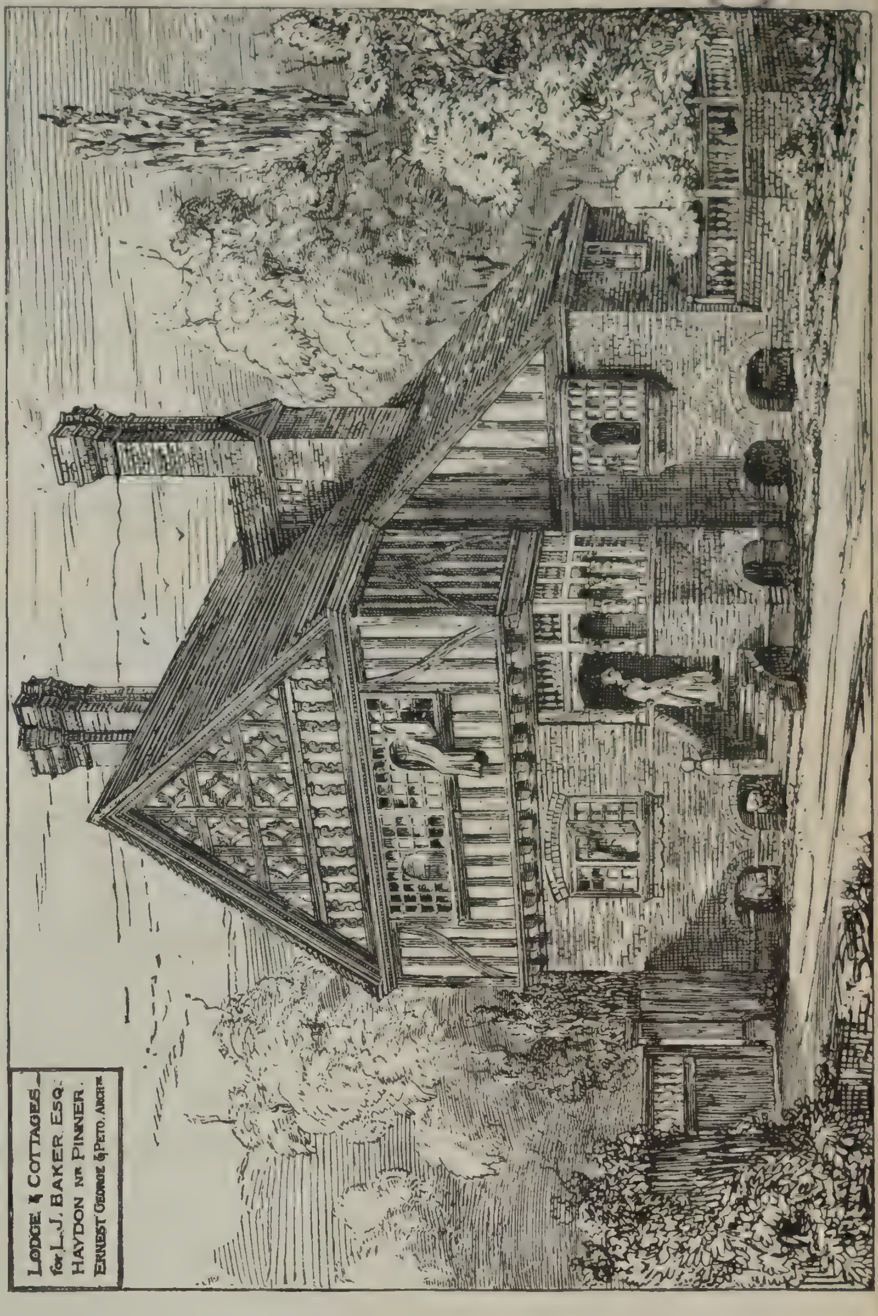
1866	$3,437,900	1873	$6,460,621
1867	2,469,001	1874	3,854,008
1868	2,520,404	1875	4,504,306
1869	3,318,496	1876	5,600,877
1870	3,017,958	1877	5,591,084
1871	5,739,592	1878	6,807,725
1872	5,625,620	1879	9,921,032

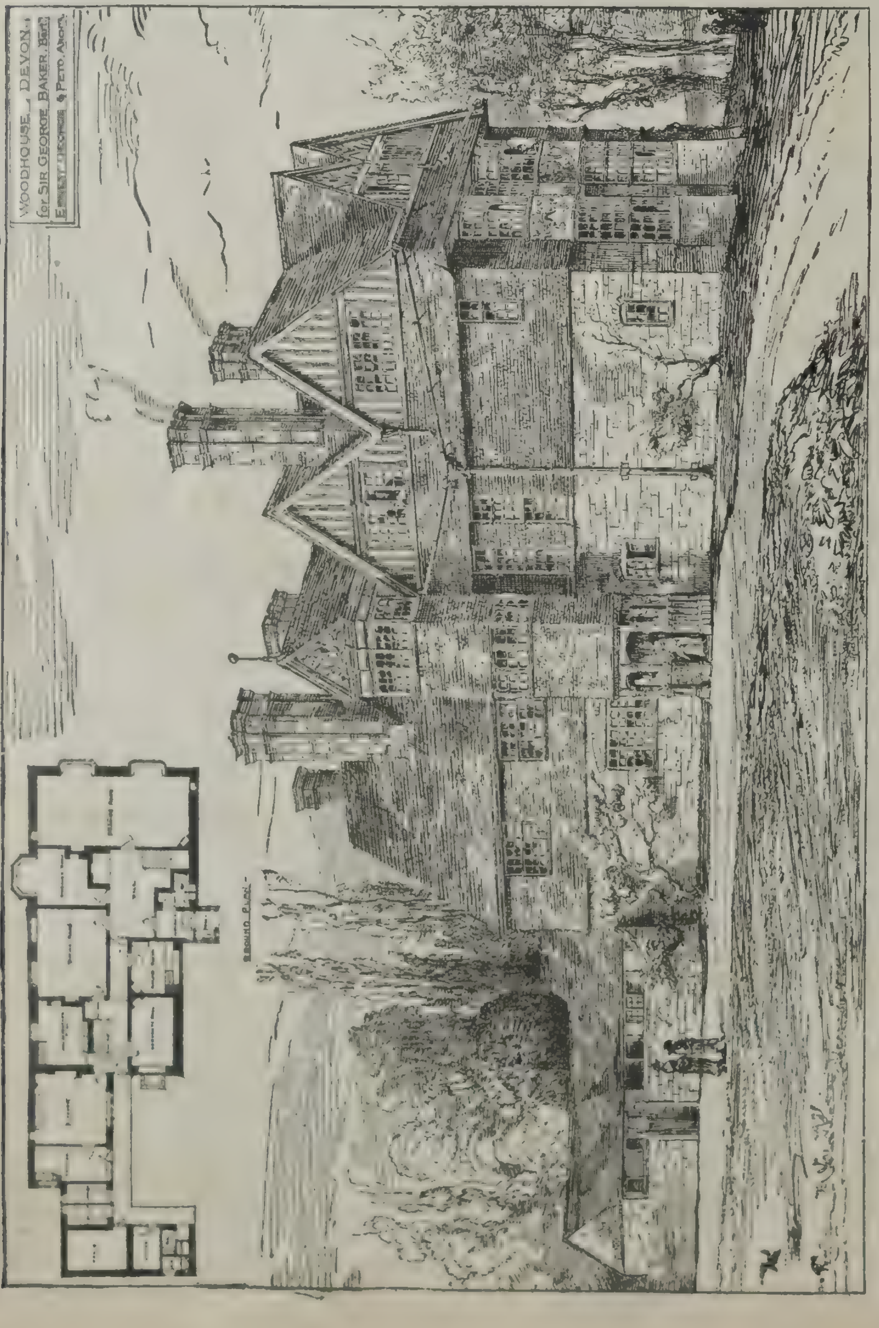
At the close of 1873 there were only 156 firms engaged in the silk manufacture, in all its branches, in the country, of which 30 were in New Jersey, 61 in New York, 25 in Pennsylvania, 22 in Connecticut, and the others scattering. The total capital invested in the industry was only $15,988,877; the total products were valued at $19,894,874, and the operatives numbered only 10,651. In 1876 the number of firms had grown to 213, the hands employed to 20,000, the products to $27,000,000. By 1879 the figures given for the whole country six years before little more than covered the silk interests of Paterson alone, which then had 102 firms and corporations engaged in it, employing 12,599 hands, with $9,955,500 invested, and produced $12,179,995 worth of goods that year.

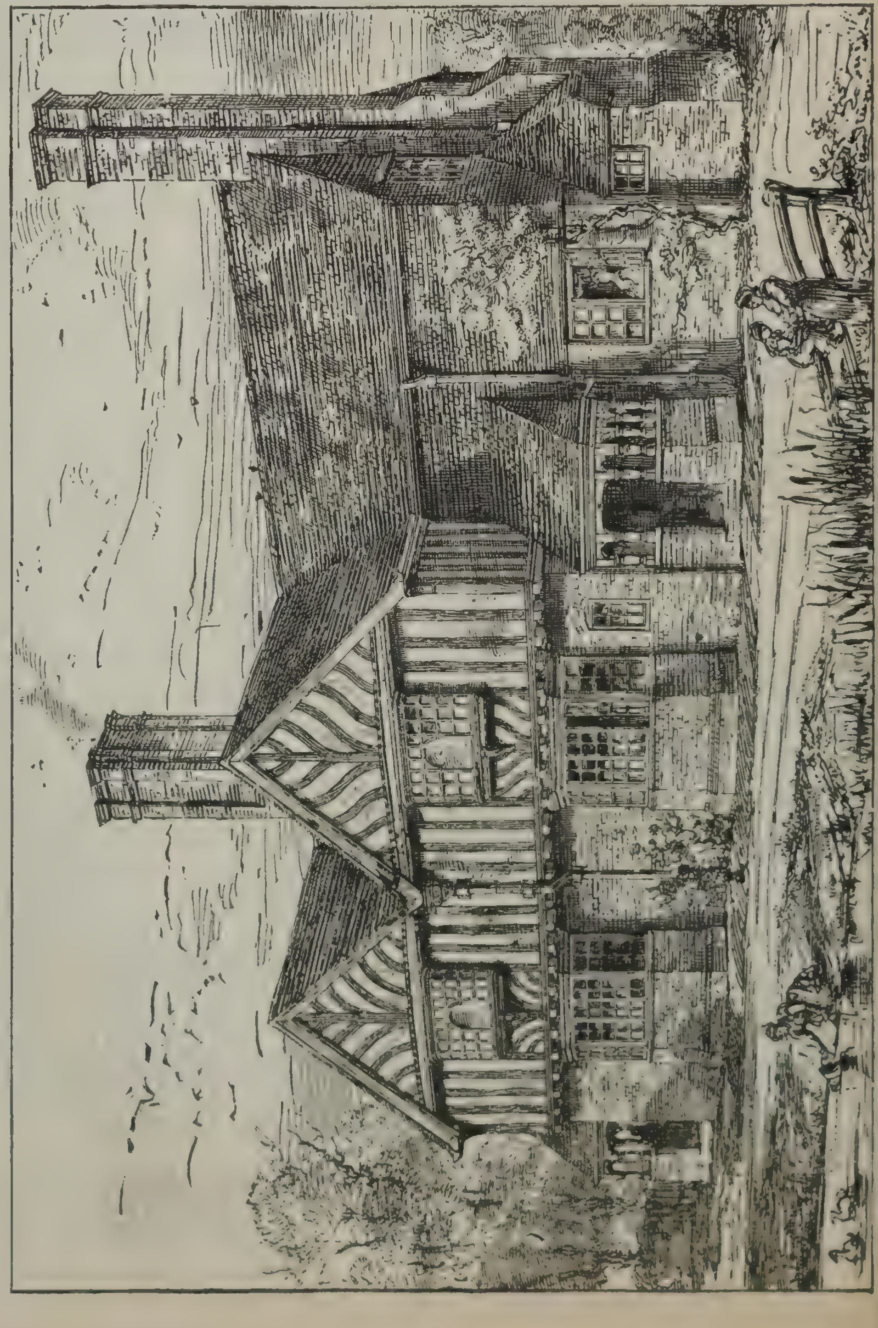
WHERE RAW SILK IS PRODUCED.

The raw silk as it comes to this country is of very variable quality. That from Italy and France is best, Japan's product and that of Broussa (or Brutia) is nearly or quite as good, and that from China is poorest. The difference amounts to as much as $2 per pound, and that simply because of the greater care employed in reeling the Italian and French products from the cocoons. The Japanese produce some exceedingly fine raw silk, quite worthy of ranking among the best, and the Chinese are fully capable of doing so, but are either too lazy or too dishonest. That the latter is the real reason is the firm conviction of some of the oldest manufacturers. They have found that where the Chinese can do so they will ingeniously load their raw silk with foreign substances—rice, sugar, etc., to make it weigh heavier, and that even when they know the deception must invitably be detected, and will lose them good and steady customers. The only way to put a check on them is by a concerted action among American manufacturers to shut out of this market all their raw silk, which does not come up to a certain standard, and that is now talked of in the American Silk Association. An experienced manufacturer here says that "all considerations are inoperative to make the Chinaman honest in his dealings with the foreigner." The raw silk comes in bales of 100 pounds, or picul bales of 133⅓ pounds, and in either case is primarily in skeins, secondarily in bundles of from eight to twenty-five pounds each, and, lastly, in the big bales. That from some parts of China and Japan is of a lustrous light golden color,


House at Westgate on Sea,
for Herbert Peto Esq.
Ernest George & Peto, Archts.


Lodge & Cottages
for L. J. Baker Esq.
Haydon nr Pinner.
Ernest George & Peto, Archts.


Woodhouse, Devon,
for Sir George Baker, Bart.
Ernest George & Peto, Archts.



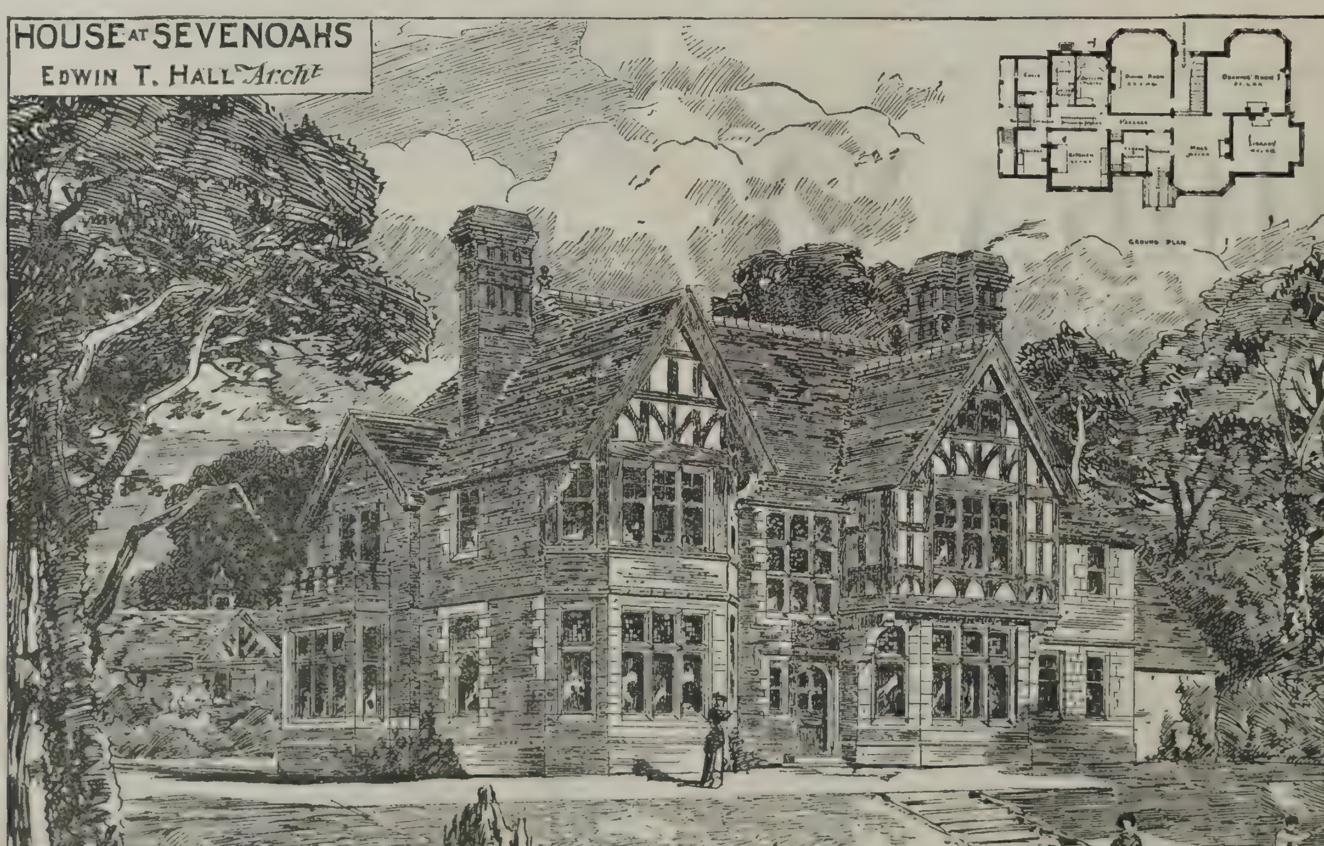
THE STEAMER VIOLET.

The Violet and Lily are sisters, but the Violet is a little the faster of the two. She is 310 ft. long over all, 300 ft. 6 in. between perpendiculars, 33 ft. beam, and 14 ft. 4 in. deep. She is certified by the Board of Trade to carry 475 deck passengers and 417 saloon passengers. The fittings of the ship are admirable, and the second-class cabins present a marked contrast to the accommodation provided for second-class passengers on board the present mail boats, which is extremely bad.

The Lily and Violet are fitted with oscillating engines with jet condensers, and two diagonal air pumps, as shown on first page. The cylinders are 78 in. diameter and 7 ft. stroke, with double piston-rods and crossheads, the piston-rods being 8 in. diameter. The entablatures are of cast iron, and of box form, and are strongly supported by eight wrought iron columns, each 7 in. diameter. The crank shafts are 18 in. diameter. Each cylinder has two slide valves worked by a link motion in the usual way, and a combined steam and hydraulic starting gear is fitted which enables the engines to be reversed with great rapidity. The paddlewheels are 27 ft. 8 in. in diameter, the floats being 11 ft. wide and 4 ft. 6 in. deep. Steam is supplied by eight rectangular boilers, working at a pressure of 30 lb. per square inch. They contain 2,152 tubes, and have a total heating surface of 12,215 square feet, and a grate surface of 470 square feet. The mean indicated horse power developed on a continuous run of over three hours was 3,220 horse power, the revolutions being 30 per minute. The boats were built by Laird Bros., and are made of steel rolled at Crewe. These vessels ply between Kingstown and Holyhead.—*The Engineer.*

HOUSE AT REIGATE.

This house stands on a site near the highroad, about midway between the Red-hill and Reigate stations on the S. E. Railway. The walls up to first floor joists are faced with best red pressed Brockham bricks, and built with a 1½ in. cavity, filled with cement, to form a vertical damp-course. The upper walls are tile-hung, and the roofs covered with red Broseley tiles, the gables being of timber, with plaster panels. The general disposition of the rooms is shown on the ground plan, the first floor being similar, with a landing of the same size as the hall below; and the attic floor contains two good bedrooms and a boxroom, with access into all roofs. The principal staircase is entirely of wainscot, wax-polished, as are also the floors of hall and parquetry-margins to floors of reception rooms. The large staircase window, the panels of entrance doors, and all upper lights of windows, are being filled with painted glass by Messrs. Campbell, Smith & Campbell; the fireplaces of hall and reception rooms are being fitted with patent ventilating grates by Mr. Boyd. The whole of the building works are being carried out in a satisfactory manner by Mr. E. Lawrance, of 16 Wharf Road, City Road, London, the contract sum being under £3,000. The architects are Messrs. Ford & Hesketh.—*Building News.*



HOUSE AT SEVENOAKS.

This house, now in course of erection at Sevenoaks Park for Mr. Charles N. Butler, is built of local gault bricks with hard red facings, all external walls being hollow. The whole of the ground floor windows and part of those on first floor have Bath-stone dressings. The "half-timbered" work is backed with bricks. The joinery of all principal rooms and the staircase is pitch-pine; the porch is of teak. The roof is covered with Broseley tiles. The work is being executed by a London builder, from the designs and under the superintendence of Mr. Edwin T. Hall, London.—*Building News.*

IMPROVEMENT IN GAS PUMPING ENGINES.

It may not be disagreeable to our readers to explain one of the uses to which the ordinary illuminating gas has been applied, and to show by what steps that which was once thought simply an object of curiosity has been adapted to a practical purpose of the useful and agreeable kind.

The long time that the phenomenon of the explosive force of the many kinds of illuminating gases was known before it occurred to any one that it might be turned to a practical use, is a singular example of the nature of discovery, and may serve to keep the intellect of inquirers on the alert. The despised fact of to-day may become to-morrow the key of the most inaccessible arcana of science. In the history of the application of gas for producing a motive power, we see, too, as in many other discoveries, that it is the first step wherein lies the difficulty and the value; when that is taken, the human invention is put upon the right scent, and the rapidity with which conclusions follow conclusions is most remarkable.

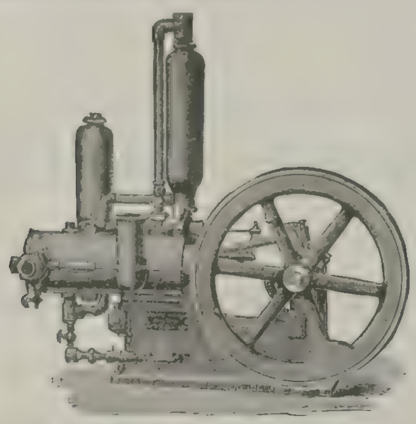


Fig. 1.—THE PLUMBERS' PUMP.

We speak more especially of the application of gas engines for pumping water into private and apartment houses. The scarcity of water in this city created a demand for small power pumping engines. The dangers and necessary expenses connected with steam power pumps render them impracticable for universal use. The expense of electric motors driven by battery power is the practical difficulty in the way of general utilization. In this city, water motors cannot be used, owing to the great waste of water to operate the machines.

The makers of the gas engine, shown in Fig. 1, were the first to undertake the manufacture of an engine that would be applicable to the purposes required. Their gas pumping engine is very simple in construction, and is specially designed for universal use. The invention of a gas engine of so great simplicity places it on a level with the most important arts of civilized life. The pumping engine, which the makers have termed the Plumbers' pump, we are informed, is used extensively by the Plumbers, Builders, Architects, and others in this and other large cities, for pumping water into private houses and country residences. The capacity of the Plumbers' pump is 250 gallons 50 feet high per hour. The cost of operating it is about 2½ cents per hour. Two larger sizes are manufactured by the Economic Motor Company, *i. e.*, one-half horse and one horse power, the capacity of which are 600 and 1,500 gallons. The large size is designed for hotels, etc., and for elevators for private houses.

As these engines can be operated with any kind of gas, they are suitable for all purposes in country places. In localities where city or coal gas is not supplied, the Económic Motor Co. furnish also a machine for making gas.

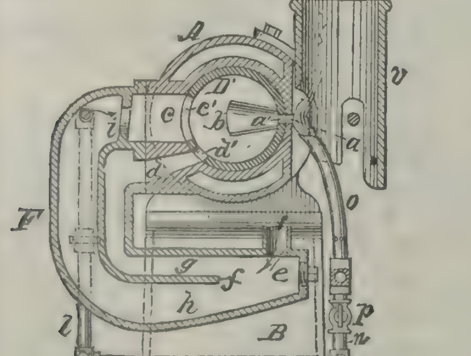


Fig. 2. SECTIONAL VIEW OF GAS ENGINE.

These engines consist practically of but three moving parts—the piston, the crankshaft, and the exhaust valve. The piston does treble duty: first, that of transmitting the pressure generated by the explosion of gas in the cylinder; second, as a valve for controlling the admission of gas and air to the cylinder; and third, as an ignition valve for admitting the igniting flame to the cylinder

The construction of the engine will be understood by reference to Figs. 2 and 3.

The cylinder, A, contains a piston, D, having a hollow cylindrical prolongation, D′, whose length is a little greater than the stroke of the engine. The forward end of the piston is connected with the crank, C, in the usual way. In one side of the cylinder there is an air and gas port, *c*, communicating with the air pipe, F; and below the port, *c*, there is an auxiliary air port, *d*, communicating with a division, G, of the air pipe, F. In the side of the cylinder, A, opposite the port, *c*, there is an ignition port, *a*, opposite which is continually maintained the igniting flame by the Bunsen burner, *o*.

The hollow cylindrical prolongation of the piston, D, has ports, *a′ c′ d′*, which coincide with the corresponding ports, *a c d*, in the cylinder during both the outstroke and in-stroke of the piston. Within the ignition port, *a′*, in the piston is supported a deflector, *b*, which directs the igniting flame toward the open end of the piston.

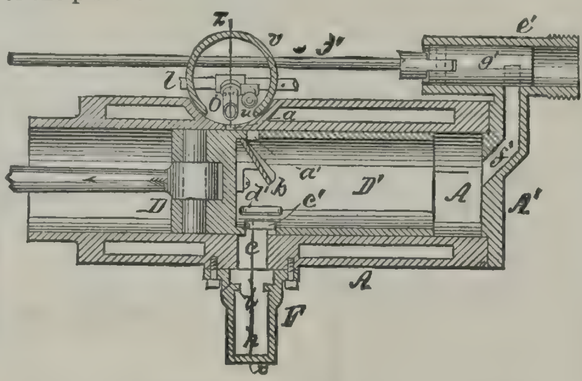


Fig. 3.—LONGITUDINAL VIEW OF GAS ENGINE.

An exhaust passage, *f*, in the cylinder head leads to an exhaust valve, consisting of a valve casing, *e′*, and a cylindrical valve, *g′*, sliding therein. The valve, *g′*, is moved by an eccentric or cam on the main shaft, through the rod, *j′*. The operation of the engine is as follows: The igniting flame being lit, and gas being allowed to flow continuously through the pipe, *l*, into the compartment, *h*, of the air pipe, F, the flywheel is turned, moving the piston, D, outward, forming a partial vacuum in the cylinder, A, into which a mixture of air and gas passes through the ports in the cylinder and piston into the prolongation of the piston; air only entering through the ports, *d d′*. When the piston has made something less than one-half of its out stroke, the air and gas port is closed by the piston in its forward movement, and the ignition ports, *a′ a*, coincide when the igniting flame is drawn in and the charge contained by the cylinder is exploded; but before the full force of the explosion is reached, the port, *a*, in the cylinder is closed by the forward motion of the piston, so that there is very little escape through the ignition ports.

The explosion propels the piston forward and turns the shaft, storing in the flywheel sufficient power to do the work required during the remainder of the revolution, to return the piston to the point of starting, and to draw in a new charge of gas and air. While the piston is making its return stroke the exhaust valve is open, allowing the products of combustion to escape. One turn of the flywheel is sufficient to start the engine.

These engines make from 150 to 300 revolutions per minute, and as the crank receives an impulse for every revolution, the motion is uniform. No gas bag is used or needed with this engine, and the manner of introducing the gas renders the engine to a great extent self-regulating. Either coal gas, water gas, or gasolene gas may be used in these engines.

The gas supply valve in the larger engine is kept open by the pressure generated in the cylinder, and when the pressure ceases the gas is automatically shut off.

We are informed these engines are largely in use, and are giving general satisfaction.

The offices and salesrooms of the Economic Motor Company are at 9 Cortlandt Street, New York city.

Composite Clinker Concrete Pipes.

According to a system introduced 'y M. Delune & Co., and described in a recent issue of the *Revue Industrielle*, clinkers, bricks broken small, and similar granular refuse, a good deal of which is produced in gas works, may be utilized in the construction of drain pipes. These pipes, which are made in lengths of 3 or 4 feet, according to their diameter, are formed of two longitudinal halves of distinct composition, but perfectly joined by the process of manufacture, and forming a strong whole. The half which is intended to be placed downward in the ground is made of ordinary concrete, impermeable, perfectly rendered inside, and serves as a chute for the drainage water; while the upper half is made of a very porous concrete composed of eight or ten parts of rubbish to one of cement. The cement used in making these pipes must be of superior quality, so as to secure a high degree of cohesion between the other material, while at the same time leaving so much porosity in the mass that, as ordinarily made, the volume of the interstices is 40 per cent of the whole. The joints of the pipes are in the form of a simple spigot and socket without projections. The advantages claimed for theso pipes are convenience of manufacture anywhere, the purchased material being restricted to the cement. They are much cheaper and stronger than earthen drain pipes, and are of wider utility, since they can be used for purposes of semi-filtration. As to their strength, they are said to be capable of withstanding an interior pressure of two atmospheres.

Cardboard Enamel.

Take one pound of parchment cuttings, one-quarter pound of isinglass, and one-quarter pound of gum arabic in four gallons of water. Boil in an iron kettle until the solution is reduced to twelve quarts; it is then removed from the fire and strained. The solution is divided into three parts of four quarts each; to the first portion are added six pounds of white lead, ground fine, in water; to the second portion are added eight pounds of white lead; and to the third are added six pounds of white lead. The sheets of paper or cardboard are stretched out upon flat boards and brushed over with a thin coat of the first mixture with an ordinary painter's brush; the paper is then hung up to dry for twenty-four hours. After this the paper is ready to receive a coat of the second mixture, and is again hung up to dry for twenty-four hours; the paper is again treated in the same way with the third mixture, and dried for twenty-four hours. After this it receives a high gloss, which is obtained by laying the work face downward on a highly polished steel plate, and then passing both with great pressure between a pair of powerful rollers.

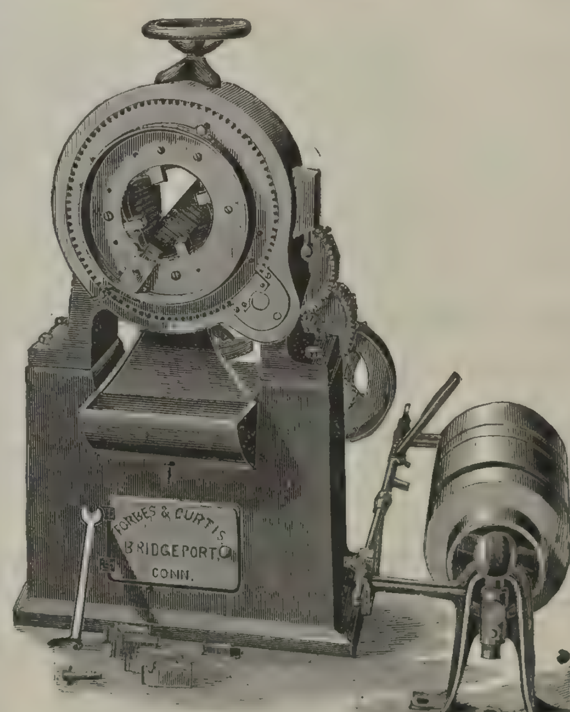
A NEW POWER PIPE CUTTING AND THREADING MACHINE.

The engraving represents a new machine for cutting and threading pipe, manufactured by Forbes & Curtis, Bridgeport, Conn.

The bits or dies are four in number, and carried by a powerful gear, which is furnished with a lead-screw at its back. These bits are worked forward or back by the throw of a cam-ring, which is operated by means of a lever, allowing an adjustment for variations in size of fittings. One set of bits threads all sizes of pipe from 2½″ to 4½″, and the second set from 4½″ to 6″. The lead-screw is engaged with two large lead-screw blocks, one of which can be seen at right of cut, about the middle of the shell. By means of handles these blocks are thrown out of gear when the thread is cut, and on opening the bits or dies, the gear can be at once drawn forward, and the dies closed ready for another pipe.

In cutting off, the gear is sent as far back as possible into the shell, and held there by means of a pin (not shown in cut), the lead-screw blocks of course being thrown out. The cut-off is actuated by a worm and wheel, which gives a steady, powerful feed.

The vise jaws are 12″ in length, and of a strength



FORBES & CURTIS' PIPE CUTTING AND THREADING MACHINE.

much beyond requirements. The gearing is 2½″ face; the driving cones have two changes of speed, 3 inch face.

The countershaft is arranged for open and cross belts, allowing a few turns backward to be made, in order to take off any burr there may be left on the pipe before opening the bits.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) If X and S., "readers for many years," will send their address, we will mail them an answer. Their question is not of sufficient general interest to take up room with here. Inquirers should read the notice at heading of this department.

(2) W. A. C. writes: In scaling saw logs by Doyle and Scribner's rule, should we allow half inches in measuring or should inches be counted, and not fractions of an inch? A. Use inches only in the register; when measuring, take the nearest whole number.

(3) W. K.—Your 1 pound of mercury will occupy a length of 2·564 inches in a 1 inch tube, and will expand, from zero to 90°, $\frac{1923}{100000}$ of an inch, or decimally 0·01923 inch.

(4) G. E. A. writes: I have made soldering iron of copper, which I cast in a mould. Now, when I want to hammer the copper into a point, it breaks off, whether cold or hot. 1. Can you tell me a remedy for it, so I can hammer it? A. Good copper can be hammered at a red heat; probably you have not pure copper. Better cast the point on. 2. What is an electrode? A. Electrodes are the poles of the electric circuit.

(5) H. W. S.—There are records of rainfall in the United States in a few places for 50 or 60 years past. The early records are not strictly reliable. The whole record shows variations of rainfall through decades of years, but not equalized, nor corresponding with any astronomical cycles. The reliable time of observation has not yet disclosed a secular decrease of rain for the United States, although in special localities such may be apparent.

(6) P. D. P. writes: Our boiler feed pipe and heater pipes are partly filled with hard lime scale, and will not work. How can we clean them? Have tried burning, but could not loosen scale. We keep boiler clean by using zinc scraps. A. We know of nothing cheaper than to renew the pipe if required at once. Filling the pipe with a solution of hydrochloric acid 1 part to water 6 parts will soon dissolve the lime, when it can be washed out. Not knowing what your incrustation is, whether carbonate of lime, sulphate of lime, or their mixtures with alumina from your clay beds, we are at a loss to say exactly what you require, but would recommend you to try to purify the feed water by filtration, by acid and soda treatment in a large tank, and settling, or heating the water in the tank by a coil, using the exhaust steam, or otherwise changing your boiler cleaning method from zinc scrap in the boiler to caustic soda in the feed water, about a quarter of a pound to a hogshead of water twice a week, and clean out boiler thoroughly of sediment once a month, or oftener if required.

(7) S. H. R. asks (1) if there are any acids or any compounds with acids that he can use to cut or eat through plate iron an eighth of an inch thick. If so, how to use same and with what results, the time it takes, etc.? A. Use nitro-hydrochloric acid equal parts, with fresh renewals every half hour. You may get through an eighth inch of iron in 5 or 6 hours. 2. The best book for information on the production and working of iron and metals. A. We recommend as the best book Osborn's Metallurgy of Iron and Steel (American practice), with large plates and illustrations, 8vo, $25. A cheaper work by "Greenwood," on the practice and theory of manufacture of iron and steel, $2. A general work comprising the manufacture and working in metals and alloys, by Byrne, "The Practical Metal Worker's Assistant," $7. All or any of which we can furnish.

(8) G. S. writes: Is there a formula by which to determine the temperature of water in a boiler generating steam under any pressure, say from 1 to 200 pounds per square inch? A. The formulas for determining temperature and pressure of water and steam as in a boiler under pressure are derived from the experiments of Regnault and others, and are tabulated in engineering works. For full explanations and tables see Haswell's Engineer's Pocket Book, $4.50, which we can furnish.

(9) B. M. G. and others.—A full illustrated description of the cable grip in use on the New York and Brooklyn Bridge, and the mechanism for operating it, was printed in the SCIENTIFIC AMERICAN of October 13, 1883.

(10) L. S. asks how modeling wax is made, such as sculptors sometimes use for modeling very small figures, etc. It is made of white wax melted and mixed with lard to make it workable. In working it, the tools used, the board or stone, are moistened with water, to prevent its adhering; it may be colored to any desirable tint with a dry color.

(11) W. W. asks how to varnish chromos. A. Take equal quantities of linseed oil and oil of turpentine, thicken by exposure to the sun and air until it becomes resinous and half evaporated, then add a portion of melted beeswax. Varnishing pictures should always be performed in fair weather, and out of any current of cold or damp air.

(12) C. B. asks what will take machine oil spots out of plain colored wall paper. A. Oil stains may be removed from paper by applying pipe clay powdered and mixed with water to the thickness of cream; leave on for four hours.

(13) E. G. P. asks what is used to kill the odor of benzine. A. Shake repeatedly with plumbate of soda, made by dissolving oxide of lead in caustic soda, and rectify. Simply shaking with charcoal and filtering will partially remove the odor.

(14) J. S. asks about the preparation of quicksilver for making mirrors, and the mode of applying same to the glass. A. The essential features of the process are the coating of the glass with tin foil, and then pouring quicksilver or mercury on the tin, thereby forming an amalgam which adheres to the glass. The exact method is given in Spons' Workshop Receipts, 1st series, which we can send for $2.00. The remuneration for such work is not high, and the wages are similar to those received by an ordinary mechanic.

(15) W. H. B. asks: 1. How much less is obtained by assaying copper by the dry method than by the wet? A. The fire assay of copper is by no means accurate, while the wet method of separation by the battery is very exact. 2. What is the difference between control assays and that of ordinary assays? A. Control assays are methods used to corroborate results obtained by other processes.

(16) A. P. S. asks for (1) a good solvent for nicotine. A. Nicotine is soluble in water, alcohol, and ether. 2. Several common roots, like the carrot, that will sprout or blossom when hollowed, hung up indoors, and filled with water. A. The sweet potato is said to be very beautiful when used as described by you. Wet sponges filled with seed are likewise commonly seen.

(17) W. J. H. writes: 1. A clock has twelve hands, and at twelve o'clock are all started together from the same point. The first hand makes a tour of the dial in one hour, the next in two hours, next in three hours, etc.; how long will it take all the hands to meet at their starting point? A. 27,720 hours, that number being the least common multiple of all the terms from 1 to 12. The 12 hour revolution hand goes around 2,310 times; the 11 hour hand, 2,520 times; the 9 hour hand, 3,080 times, etc. 2. I desire a recipe for making an indelible ink that I can use with an ordinary rubber stamp. A. See the recipe given for an indelible stamping ink, published on page 19 of SCIENTIFIC AMERICAN for July 11, 1885.

(18) J. N. writes: During an argument to-day, one of the parties asserted that a ton of wood and a ton of iron placed in a vacuum, the wood would weigh more than the iron. State if such is the case, and if so, why so? A. The wood would be the heavier on account of its larger volume of air. Its bulk would represent a cubic foot of air at 60° Fah., weighing 536·96 grains.

(19) F. P.—Valves should have the full area of the suction pipe, and should lift ¼ of their diameter.

NEW BOOKS AND PUBLICATIONS.

THE MODERN HOUSE CARPENTER'S COMPANION AND BUILDER'S GUIDE. By W. A. Sylvester. Boston: Cupples, Upham & Co., 1884.

Mr. Sylvester began some years ago the practice of carrying with him a small memorandum book, in which he entered convenient rules for doing various kinds of work, and different items of value in making out estimates. From time to time he added to this collection such bits of knowledge as he found useful to a carpenter, until the note book became so helpful to him that he conceived the idea of enlarging and publishing it, in the hope that it would prove equally valuable to his brother workmen. Originating in this way, the book is eminently practical and compact. The first portion is devoted to a *resumé* of the geometrical problems applicable to carpentry. The usual markings on rules and squares are explained at some length, particular attention being given to the slide rule. The article on the strength of materials, and the rules for determining their proper dimensions, will be found very valuable by many who have hitherto regarded this part of their work as something of a bugbear. A glossary of architectural terms is given, together with the floor plans of several moderate size houses. Forty-five full page plates accompany the text.

THE MODERN HOUSE CARPENTER'S COMPANION AND BUILDER'S GUIDE. By W. A. Sylvester.

A convenient hand book, written by a practical workman, and giving just about the information that every carpenter and builder should keep always within reach. Contain rules for designing, estimating, and determining the proper proportions of constructive materials, a glossary of architectural terms, and several floor plans for medium sized houses. Fourth thousand, 45 full page plates, cloth, $2.00. Address Munn & Co.

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Advertisements.

THE NEW "BURGTHEATER" IN VIENNA.

At last the new "Burgtheater" in Vienna is completed. We say "at last," for work was begun on this new theater more than ten years ago. One after another, monumental architectural works have been erected, which are no less grand and beautiful than this. They were finished long ago, and given over to their respective uses—the Parliament buildings, the "Rathhaus," the University; but Baron Hasenauer, who had charge of the construction of this building, as well as of many others, could not bring himself to the quicker *tempo* of Messrs. Hansen, Schmid, and Ferstel. The citizens of Vienna were naturally impatient to see their beautiful "Ringstrasse" completed, and only the Hasenauer buildings were needed to make it perfect.

The building was built according to the plans of Semper and Hasenauer; for, as in the other great buildings erected by Hasenauer, the new palace and the museums, Semper's plans served as a foundation. All the modern improvements in the architecture of theaters have been embodied in the new theater, for the terrible catastrophe at the Ringtheater taught a lesson which has not been forgotten, and the greatest care has been taken to guard against fire.

The new "Burgtheater" stands directly opposite the imposing "Rathhaus" (senate-house), and is separated from the same by a charming park; to the right stands the University, and to the left the Houses of Parliament. In order to be worthy of such company, and not be overshadowed by these buildings, it was necessary that the theater should be very grand. The most important requirements have been perfectly fulfilled; beauty, elegance, appropriateness, and security against fire, nothing has been neglected.

The principal part of the building stands out strongly, and is flanked on either side by a pavilion-like wing. The audience room will accommodate about two thousand people.

The public and the actors alike rejoice in the new Burgtheater, for which they have waited so long.

THE NEW IMPERIAL PALACE THEATRE, VIENNA. Original Design by J. J. Kirchner.

A New Island in the South Seas.

According to the *Melbourne Argus* of December 10, further news respecting the volcanic outbreak which recently occurred in the Friendly Group has been received from Fiji *via* Auckland. Intelligence concerning it first arrived there by the schooner Midge, from Tonga. Before the vessel arrived, however, the eruption had already reported itself to the eastern portion of the Fiji group, and the *Argus* correspondent furnishes the following account of it:

"At Ogea, one of the island outposts lying nearest to the point of eruption, and distant from it about 175 miles in a southwest direction, heavy discharges as of siege artillery were heard on October 14, and continued at short intervals up till the 17th. It is to be noted in connection with this that the outbreak occurred, or was first noticed, in Tonga on the 12th, and that mention is made of 'a low rumbling noise at intervals during the night.' During the continuance of these heavy discharges, Ogea was frequently and very violently shaken by earthquakes, so that the people were in a state of great consternation. At night time a lurid glare, as from a great fire, was visible in the direction of Tonga, and these phenomena culminated in a terrific roar on the morning of the 17th, such as might be produced by thousands of big guns being discharged simultaneously. Next day a small vessel which had been working the open sea between the Fijian and Friendly groups called into Ogea, and reported having passed through vast fields of pumice. This served to confirm the idea generally prevailing that a terrible calamity in the form of a volcanic outbreak had befallen and had overwhelmed Tonga."

The Tonga correspondent of the *Fiji Times*, who was an eye-witness of the eruption, has communicated the following account of it to that journal:

"On the night of Sunday, October 11, 1885, more than one slight shock of an earthquake was felt, and lightning was seen at intervals at different quarters. Several persons noticed a low rumbling noise at intervals during the night. At sunrise on Monday morning, October 12, the natives reported that a steamer was coming in. The Tongan Government was induced to send out the schooner Sandfly, and about noon on the day the outbreak was first seen Dr. Buckland, accompanied by the Premier and various officials, started to see the volcanic eruption which it was evident was going on. The Sandfly returned on the 16th inst., and reported having reached the scene of the eruption on the 13th, but too late to see much; that on the following morning a small island became for the first time visible, and that the vessel had approached within about a mile of the shore, but a strong current prevented nearer approach. On October 17, a number of residents chartered Tugi's schooner, and started for the spot, and on the succeeding morning witnessed a spectacle of such surpassing magnificence as men have seldom been permitted to view. An island of, I believe, not less than nine miles superficial area was seen by us, which had been upheaved, presuming the Sandfly's observations to be correct, within four days. On its shore a submarine volcano was belching out a fearful quantity of what I believe to be steam and salt water, throwing it upward in a column for a distance, I was told by a competent gentleman, of a mile. To give an accurate description in detail of the column and eruption generally is impossible. It is indescribable. The shapes assumed by the steam clouds, after the greatest height had been reached, were inexpressibly beautiful, and were fantastic to a degree. While these clouds were still wreathing and curling, another and another column, with well-defined lines, would shoot upward, and the downpour of liquid and the wreathing and curling were again and again renewed. The island, named by many 'Fakaogo fei lagi,' or Takaogo Island, is situated about sixteen or twenty miles to the northwest of Honga Hapai. I have not a chart to refer to, but believe it is on the site of the Culdibras (?) Reef, marked on the chart, and which is some distance south of Tonga and Kao. Vessels coming here from Fiji will be able to visit the island without going much from their course. At night time flashes of light are seen, but whether proceeding from flames of volcanic fire or from the electricity generated during the condensation of the volumes of steam, will be best known to scientific people. Many and various are the conjectures as to how the island has been formed, and conjectures alone can be made until the island is visited. The whole matter is likely to create great interest, and will afford an opportunity to scientific people to ascertain, with a tolerable amount of certainty, the exact manner in which these islands of the Pacific have in past ages been produced. The height of the island on the occasion of the visit of the Sandfly was from twenty to thirty feet, and when we saw it on Saturday it appeared to be from two hundred to three hundred feet."

The yearly exports of umbrellas from England are valued at £581,000.

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For the past few years the attention of architects, builders, and real estate owners has been directed largely to the improvement in building, to render the same proof against fire and its attendant losses.

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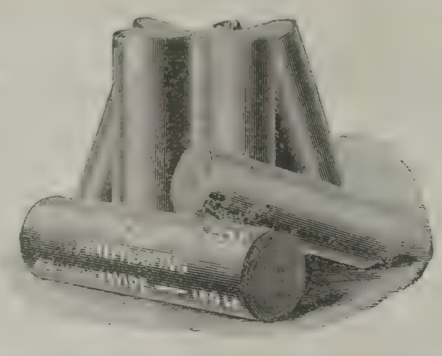

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The problem which interests the real estate owners most is how to combine security against fire without too great an expense.

It is but a few years ago the problem was solved by the introduction of asbestos flooring felt, by the use of which a building can be rendered comparatively, if not absolutely, fireproof. To construct a building absolutely fireproof necessitates an outlay of money and material such as would render such buildings rare even in great cities.

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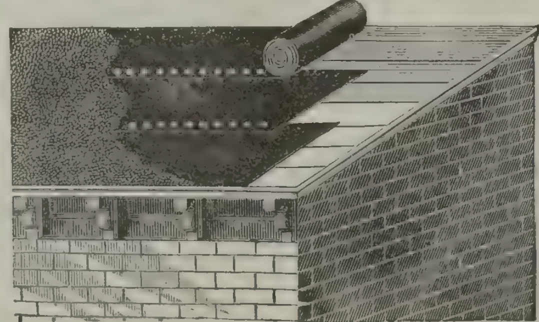

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It yields no dust, and being composed of a mineral fiber, it cannot decay. For use under slates the fact of its non-conducting heat renders it superior to any other sheathing, and under shingles or clapboards it has no superior. As a lining for well rooms, flues, or any hot or cold air conductors or ventilators, its fireproof and non-conducting qualities are readily apparent.

Factories, apartment, tenement, or flat houses, protected by this felt, could be rendered sufficiently fireproof at a small cost to guard the lives of all the inmates from the flames, and to cause the damage, if a fire did occur therein, to be localized to the rooms in which it commenced, and the burning to the simple consumption of furniture, contents, and finish of said room, as the flooring felt is absolutely indestructible by either fire or acids.

There have been numerous practical tests, proving it to be all that is claimed for it as a preventive of the spread of flames and an efficient aid in rendering buildings lined with it slow of combustion.

It has the indorsement of the leading architects of the country, and the appreciation of its fireproof qualities has been demonstrated by the building laws of some of the largest cities requiring its use in all buildings exceeding a certain height.

Its use, though intended principally for building purposes, is by no means confined thereto. For fireproof linings of all kinds in safes, railroad passenger and freight cars, refrigerators of all kinds, and any other purposes requiring a fire or acid proof or non-radiating material, it stands without a superior, and the low price at which it can be obtained places it within the reach of all.

As a deadener of sound, one thickness of it is considered equal to two or three thicknesses of ordinary sheathing paper.

To meet the requirements of the community for a reliable roofing which can be easily applied, and at a price within the reach of all, The Asbestos Packing Co.'s roofing finds a steady and increasing sale. It is adapted for steep or flat roofs, and will withstand the effects of any climate. It consists of two or three layers of roofing felt, thoroughly saturated with an impervious compound, and cemented together with a continuous layer, or in three ply with two layers of a waterproof and permanently flexible cement, and this surface is coated after the felt is laid with a very durable liquid asbestos roof coating and then sanded. The nature of the compound used in saturating and cementing together, and the surface coating of the felt, is such that the roofing will not dry up and become brittle by evaporation under exposure to the sun. For covering old roofs this has no superior, considering the small cost.

Asbestos cement felting is well known from its use as a steam pipe and boiler covering and its use in the place of plaster between floors or on ceilings is being rapidly appreciated by intelligent architects and builders; and we would advise our readers interested in the subject to apply to The Asbestos Packing Co., 169 Congress St., Boston, or 33 John St., New York city, who are the manufacturers of these articles, and who will be pleased to furnish you further information, with samples and illustrated pamphlets regarding the same.

Prehistoric Dentistry.

Dr. Van Marter, of Rome, who has been investigating the evidences of early dentistry, finds a number of authentic cases which possess considerable interest. Among the Etruscan relics in the library of the Barberini Palace, he found four natural teeth bound together with pure gold bands, and attached to adjoining teeth. They were taken from a tomb at Palestrini, near the city, and had evidently been used to supply a deficiency in the natural set of molars. The Etruscan remains in the Museum of Bologna show no signs of dental surgery, but it is a noticeable fact that some of them contain but twenty-eight teeth in place of thirty-two. At another tomb, belonging to the 6th century B. C., three teeth bound together with a gold band have also been found. The greatest antiquity must be accorded to the Phœnician specimen in the Louvre, at Paris, which consists of teeth roughly bound together with gold thread. As the Greek and Roman laws had their origin in Egypt, the dental art was probably first practiced on the banks of the Nile, for in the laws of the twelve tables we read: "If any one's teeth have been bound together with gold, it shall not be unlawful to bury him with it."

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One of the essential tools in every workman's set is a good screw driver. He has to use it so often that the more convenient and portable it can be made, the better. Pratt's screw driver has evidently been gotten up by a man who knows something of the discomfort of carrying around a half dozen or more separate tools in order to be able to fit different screws, for it combines all sizes of bits in the one tool. The stock is provided with a chuck, which firmly holds the driver points in place. There are ten bits, either end of which can be used, making twenty screw drivers in all. They fit any screw, from the largest to the smallest, and when not in use are stored in the handle. The tool is fourteen inches long. It is made of polished rosewood and nickel-plated steel. The Miller's Falls Co., 74 Chambers St., New York, are the manufacturers, and will send the screw driver postpaid on receipt of $1.00. Their illustrated catalogue of tools and hardware will be sent on application, and will be found attractive reading by every one interested in good tools.

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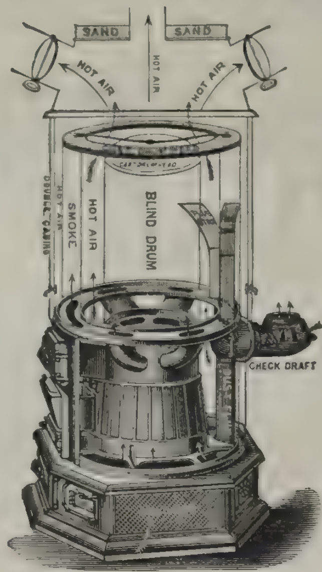

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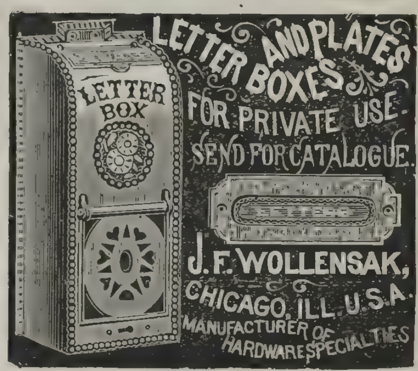

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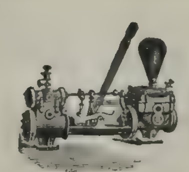

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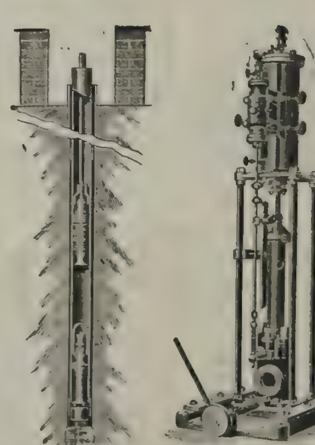

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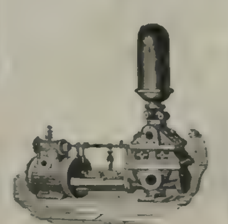

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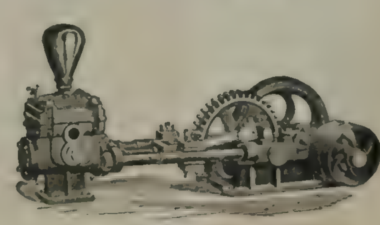

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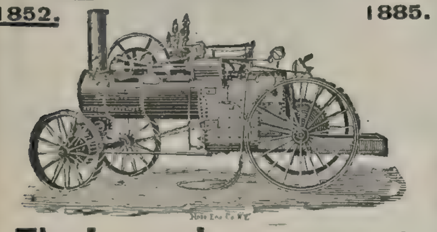

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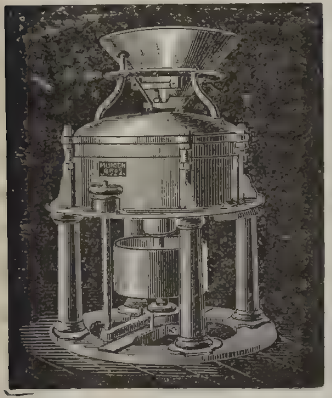

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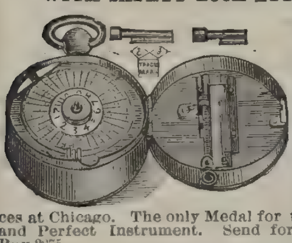

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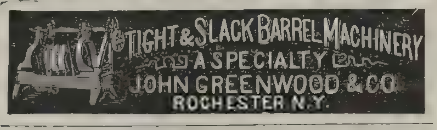

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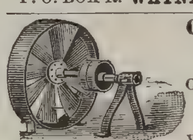

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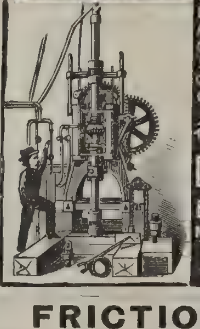

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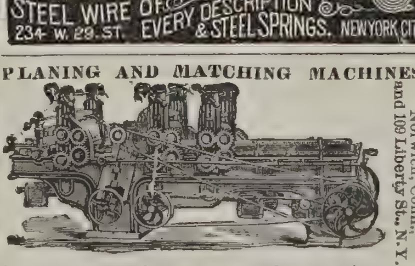

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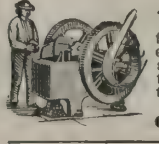

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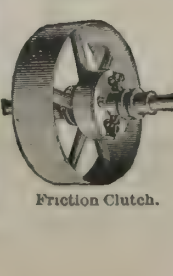

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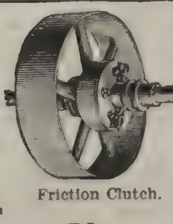

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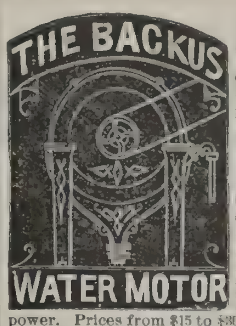

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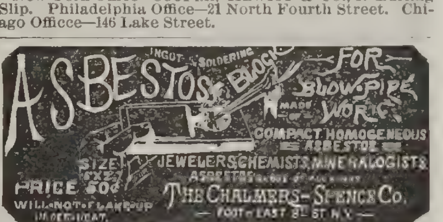

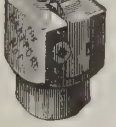

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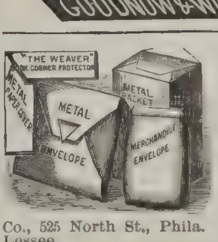

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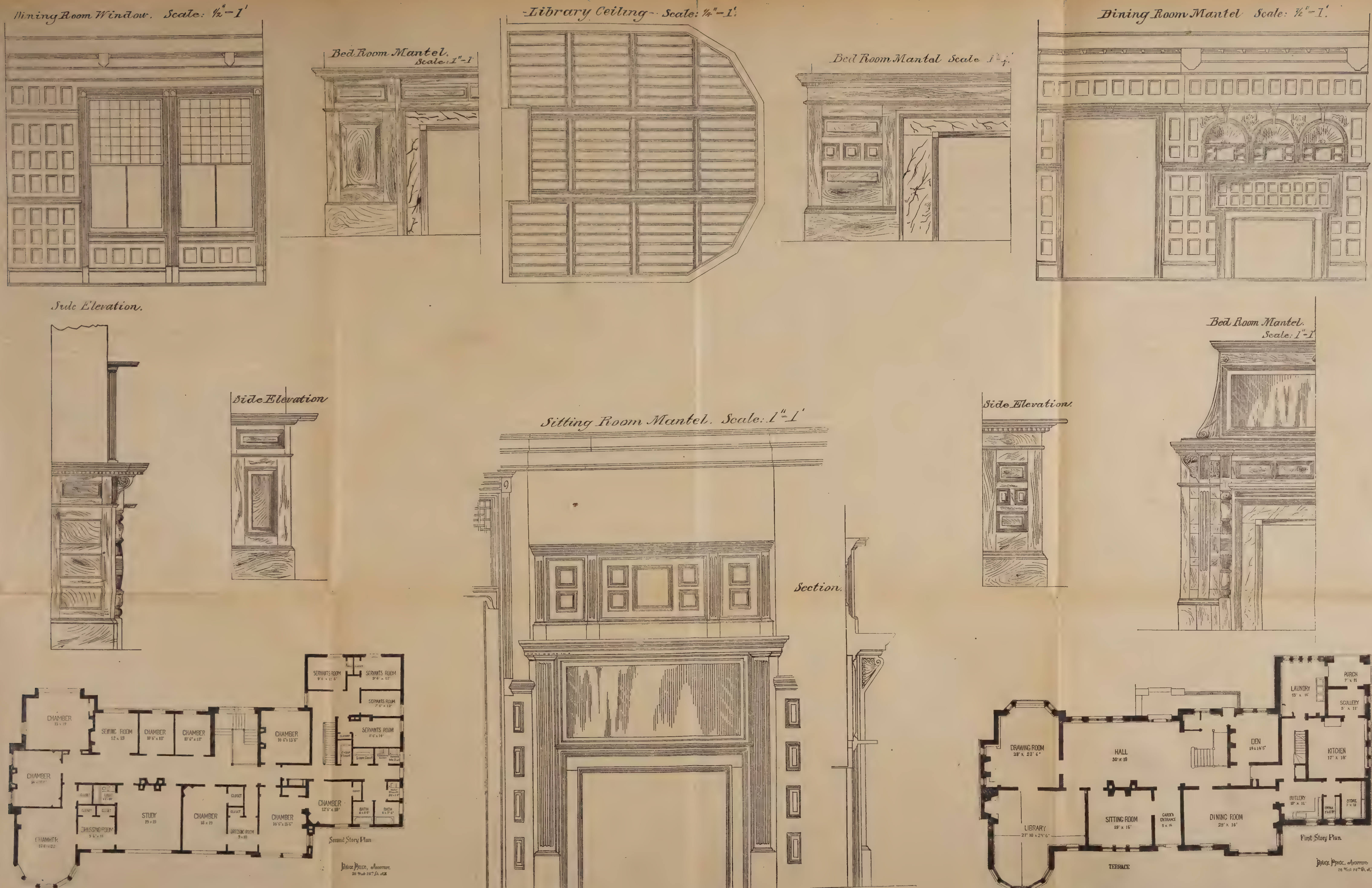

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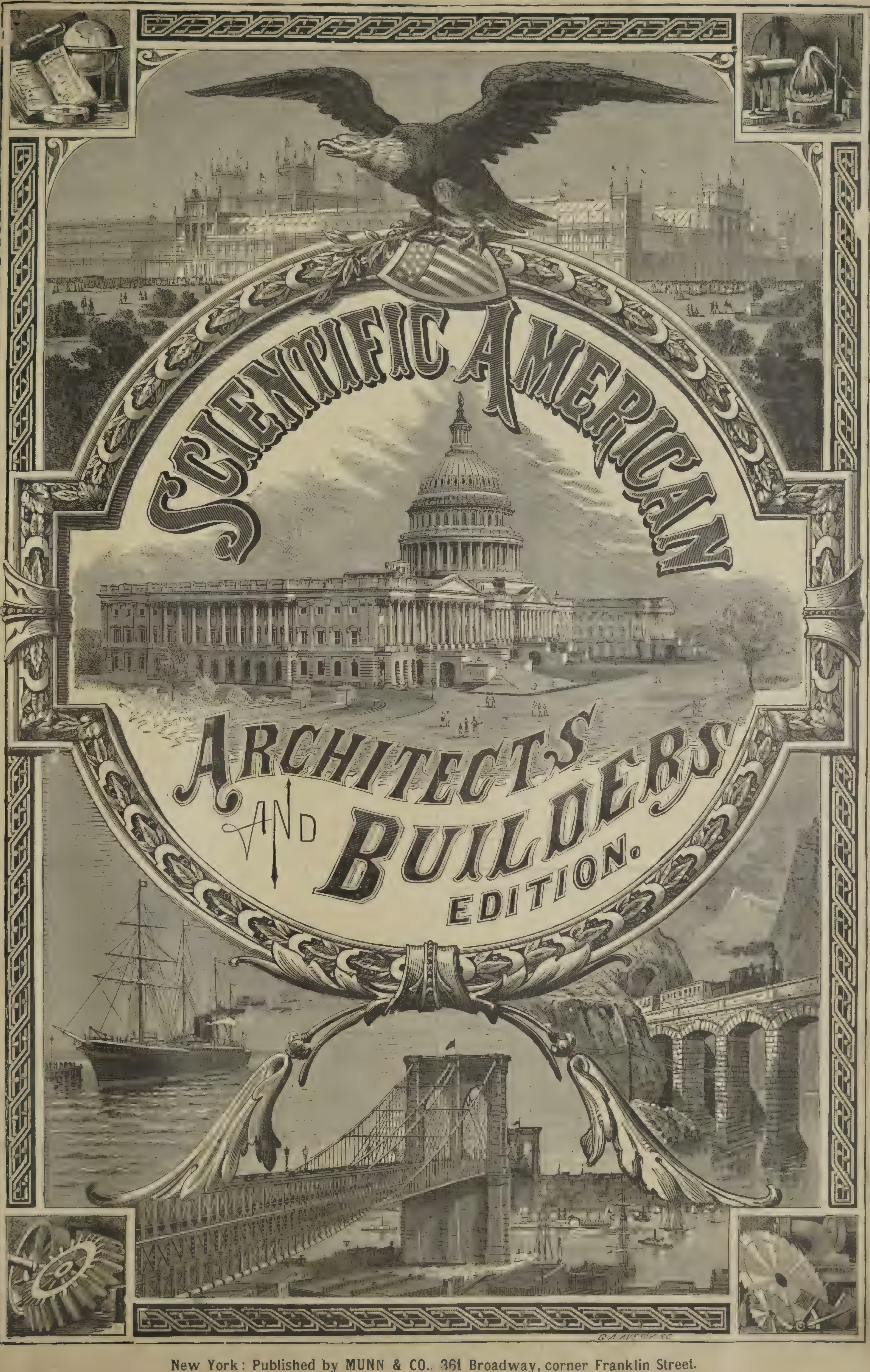

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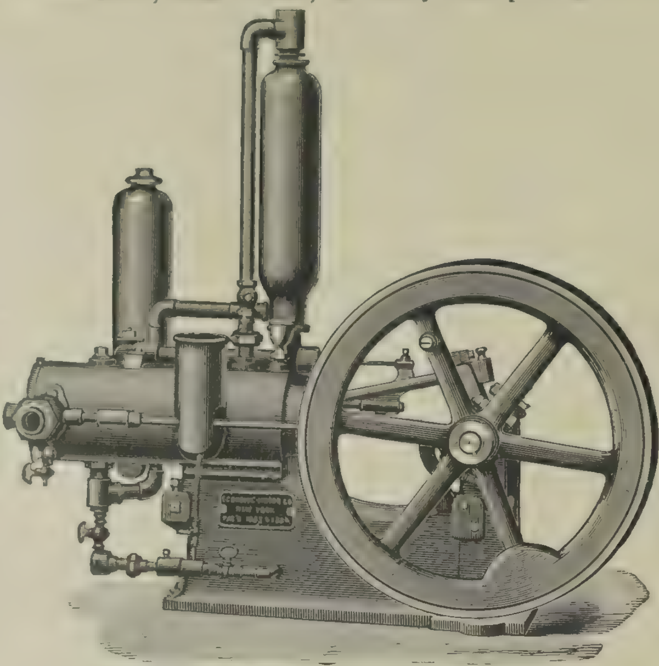

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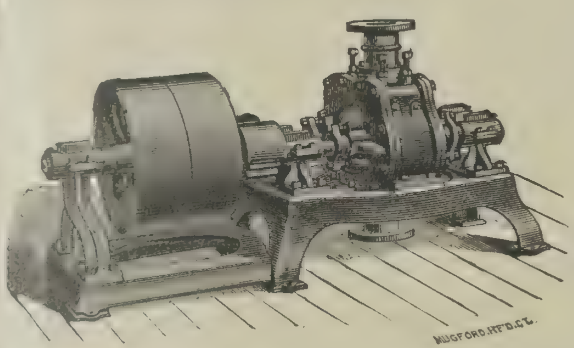

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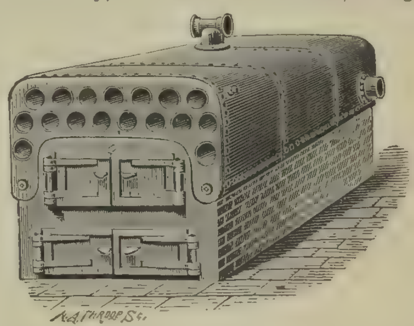

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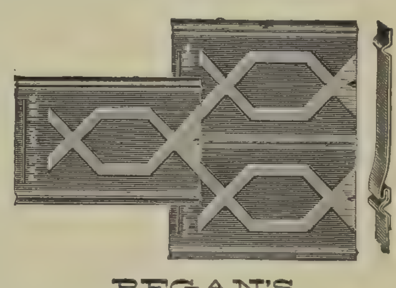

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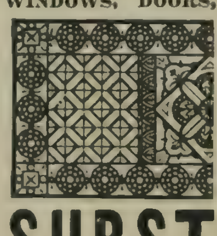

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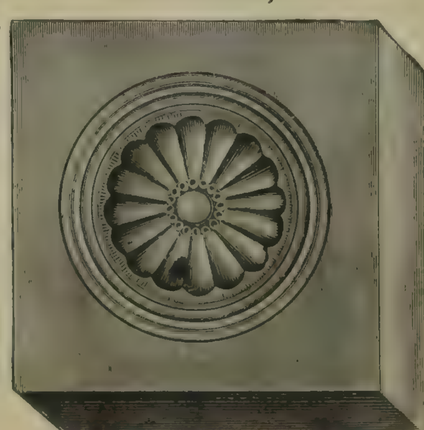

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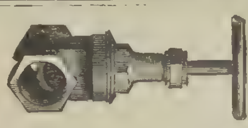

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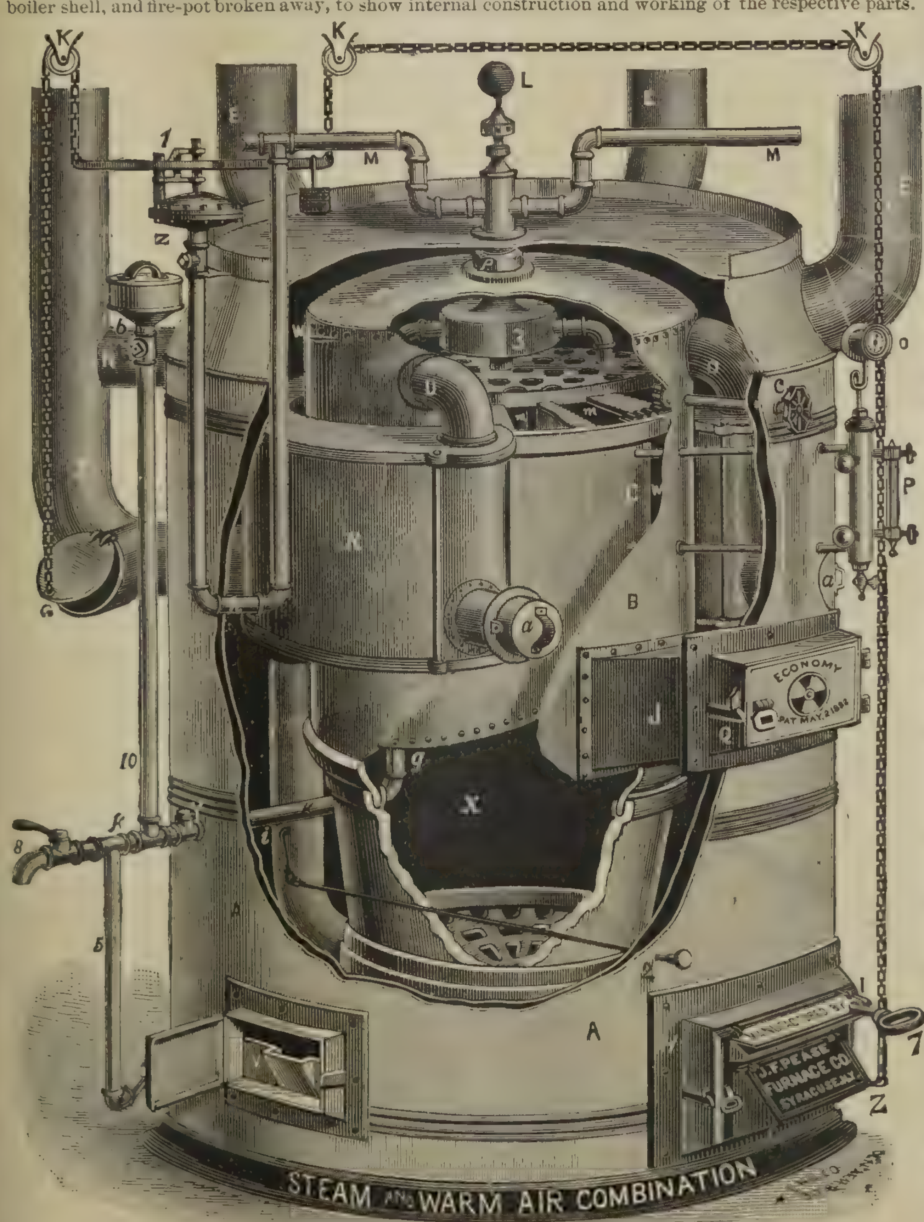
The Latest and Greatest Improvement in Apparatus for Warming and Ventilating Buildings.

Thoroughly Tested for Four Seasons.

Patented by J. F. Pease, May 2, 1882.
" " Nov. 11, 1884.

This engraving illustrates our Combination Furnace and Steam Heater with a portion of outer casing, boiler shell, and fire-pot broken away, to show internal construction and working of the respective parts.



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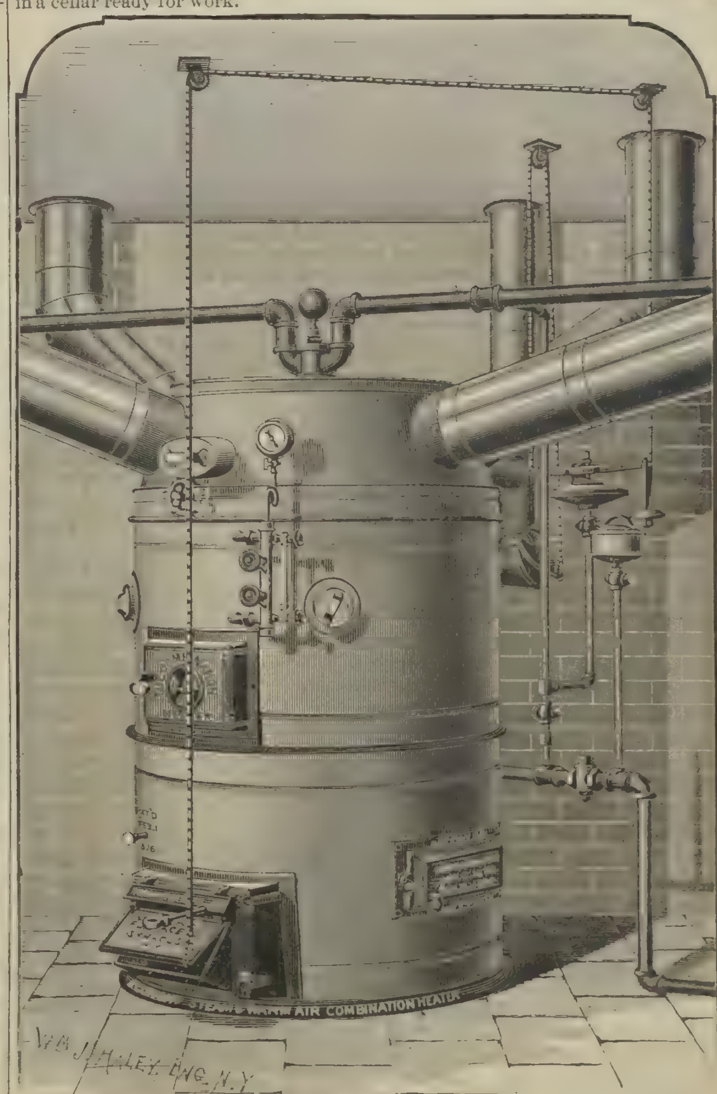
This engraving illustrates our **Combination Heater** as it appears set up in a cellar ready for work.



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This magnificent vase of marble was excavated in Italy at the beginning of this century, and soon afterward purchased for some private collection in England.

We represent two views of this vase, in order to show in all its development the interlacing of the ornament in low relief, which covers the body of the vase, enriched by some figures in unsymmetrical but very graceful arrangement. To judge by the ornamental treatment, the work may be attributed to those Grecian artists who were called upon to contribute to the glorification of imperial Roman luxury.

ANTIQUE ROMAN VASE.

Notes on Pipes of Metal.

Cast iron pipes for water should be cast from good gray metal, twice run, and of such quality that a bar 2 in. deep by 1 in. thick, placed on supports 3 ft. apart, will not break with a less load than 28 cwt. or 30 cwt. suspended in the center. A working strength of 2,500 lb. per square inch is a usual limit for cast iron; but besides the water pressure, a margin of strength must be allowed for shocks due to the closing of cocks and to the weights pressing or pulling on the pipes. One useful rule followed by manufacturers of water-pipes may be given: Multiply the internal diameter of the pipe in inches by the working head in feet, divide the product by 10,000, and add the constant number 0·30 to the result, which will give the thickness of cast iron in inches. A test of double the working pressure is allowed. The contents of a pipe can be easily found by multiplying the square of the diameter in inches by 0·34, and the product will give the contents in gallons in a foot length of pipe.

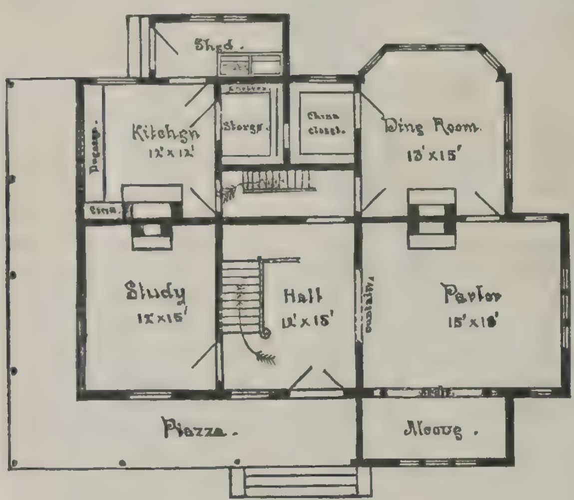
The weight of pipes can also be found by the following rule: "From the square of the outside diameter subtract the square of the inside diameter in inches, multiply the result by 7, and divide the product by 3, which will give the weight in pounds approximately of 1 ft. in length of a cast iron pipe." The exact weight can be found by using 7·4 as the multiplier. If the pipe is of wrought iron, the result found above is to be multiplied by 1·05; if of steel, 1·08; if of copper, 1·21; if of lead, 1·56. An ordinary cast iron socket pipe, 6 in. internal diameter and 9 ft. long and ⅜ in. thick, averages 2 cwt. 1 qr. 15 lb.; a 9 in. pipe, same length, ½ in. thick, weighs about 4 cwt.; a 24 in. pipe, 9 ft. long and 1 in. thick, averages 18 cwt. 2 qr. 14 lb. Cast iron flange pipes weigh a little more, two flanges being about equal to 1 ft. of pipe. The water pressure in pounds per square inch is obtained by multiplying the head of water in feet by 0·443. Box, in his "Practical Hydraulics," gives a table of the thickness and weight of cast iron socket pipes to bear safely different pressures. From this table we find the proper thickness for a 9 in. pipe with a 250 ft. head of water is 0·53; for a 12 in. pipe it is 0·61.—*Building News.*

DESIGNS FOR COTTAGES.

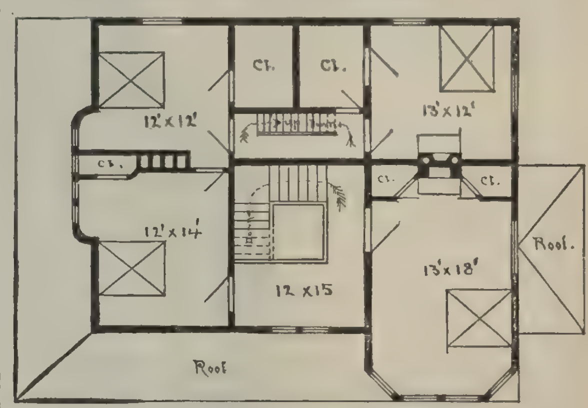
We present herewith two designs for cottages, both by Mr. Arthur L. Vaux, architect, Tribune Building, this city. The first is for a frame cottage to cost complete, with internal fittings of a unique character, $4,300. Height of ceiling: first floor, 11 ft.; second floor, 8 ft. 6 in.; a small attic. The scale will be understood by reference to the room dimensions.

The lower illustrations show a design for a country parsonage—a frame building, to cost $5,400, complete with special fittings. Ground plan, 30 ft. × 47 ft. Heights: first floor, 9 ft.; second floor, 8 ft. 6 in. Further particulars will be furnished by the architect.

DESIGN FOR A COTTAGE—COST, $4,300.

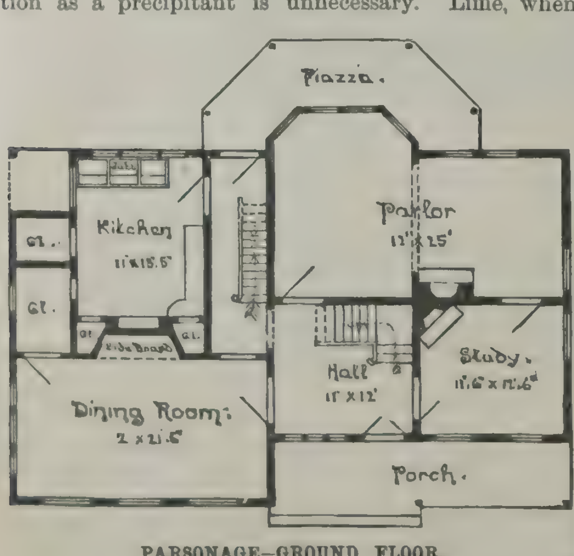


COTTAGE—GROUND PLAN.

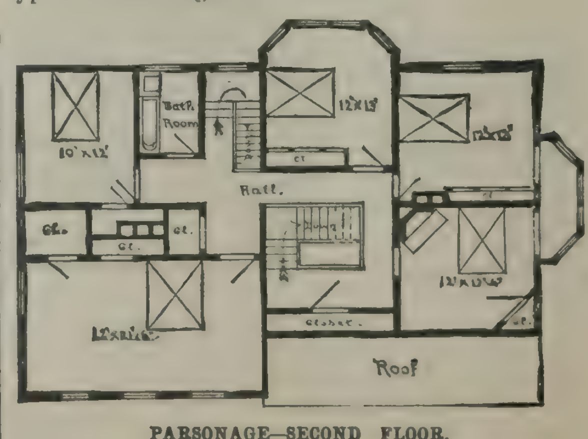


COTTAGE—SECOND FLOOR.

DESIGN FOR A PARSONAGE—COST, $5,400.



PARSONAGE—GROUND FLOOR.



PARSONAGE—SECOND FLOOR.

Sewage Treatment for a Town of from 10,000 to 20,000 Population.

The following is from the joint report of Professor Frankland, F.R.S., and Dr. Thos. Stevenson, F.R.C.P., London, on the proposed treatment of Hendon, Eng., sewage:

We understand that the effluent from the sewage must, in consequence of the site of the sewage works and the natural declivities of the locality, find its way into the small stream known as the river Brent, above the Brent reservoir; that the land is a stiff clay; and that the present population to be provided for is 11,000. We premise this, as we have not visited the site of the works:

1. Although the present population is only 11,000, we are of opinion that any good scheme should provide for a population of 20,000 at no very distant date.

2. We are of opinion that the sewage should be precipitated, and by that means clarified; but that this must be supplemented by the intermittent filtration through land of the clarified effluent.

We are of opinion that this is, under the special circumstances of Hendon, the best and cheapest mode of disposing of the sewage, and that, considering the small size of the stream into which the effluent is to be discharged, and the more or less stagnant state of the Brent reservoir, into which the stream speedily discharges, precipitation without filtration is not admissible.

3. The sewage should first be strained through metal strainers to remove the grosser substances.

4. We have deliberated as to the best method of precipitation, and are of opinion that a lime process—the use of lime without any other admixture—will be the cheapest and best; and that, seeing the effluent after precipitation and subsidence has to be filtered through land, any other addition as a precipitant is unnecessary. Lime, when intelligently, carefully, and properly applied, affords as good an effluent as any other and more costly precipitant, except perhaps lime and sulphate of alumina. But the use of sulphate of alumina is unnecessary when precipitation is to be supplemented by land filtration; and, where possible, the cost of this substance should be avoided.

5. The quantity of lime required will be about fifteen grains of quicklime per gallon of sewage, used after slaking. The lime should be thoroughly incorporated with one-sixth of the whole volume of sewage, so as to entirely dissolve the lime, and the mixture be then mixed with the remaining five-sixths of the sewage. The use of a thick cream or even thin milk of lime does not insure the full action of this substance.

6. The limed sewage should be allowed to come to *complete rest* for some hours in tanks, which should be neither very deep nor large. Care should be taken to cut off entirely the influx of fresh liquid into the tanks during the time that the sewage is depositing. The tanks for this purpose must be used in series, *i. e.*, No. 1 to be subsiding while No. 2 is filling, and so on.

7. The clarified sewage ought then to be run off and filtered through prepared land on the intermittent system. The land must be specially prepared to a depth of 6 feet to receive the effluent from the tanks, and the quantity of land ought to be not less than one acre to each 2,000 of population. Crops, such as cabbages, may be grown on the filter beds with advantage.

8. The sludge from the tanks should be drawn off, and as quickly as possible pressed into cakes by a well-known apparatus. Four tons of pressed cake may be expected from 11,000 people. These cakes may be stored without offense, and either disposed of to farmers or used to raise and improve land.

9. The sale of the pressed sludge must not be expected to cover the cost of pressing. The cakes obtained by a lime process are, perhaps, of equal value with those prepared by any other known and available process, but their manurial value is small. All solid sewage manures prepared from liquid sewage are of little manurial value, unless artificially fortified by costly ingredients. A sanitary authority cannot, in the present state of science, expect to obtain any substantial return on its expenditure from the sale of manure.

10. We are of opinion that the process we have sketched out will, if well carried out, yield a good effluent without entailing nuisance in or about the sewage works; that the filter beds need entail no nuisance whatever; and that an effluent will be obtained which will neither be itself a nuisance nor cause any nuisance in either the river Brent or the Brent reservoir.

11. The press liquor squeezed from the cakes is much more polluting than sewage itself. It should not be returned to the tanks, but should be filtered intermittently through a small plot of land. The effluent can then be mixed with the general effluent.

12. As to cost, we can only speak of the cost of the lime and the cost of pressing the sludge. The lime will cost about 6s. per day; and the pressing of the sludge, about 3s. 6d. per ton of pressed cake.

Quadruple Expansion.

A few particulars of the working of the engines of the yacht Rionnag na Mara, on recent trials, may not be without interest to some of our readers, says the *Mechanical World*. This yacht, built to the order of Mr. A. G. Pirie by Messrs. J. Reid & Co., Port Glasgow, is the first vessel fitted up with Messrs. Rankin's patent six-cylinder disconnective quadruple expansion engines working on three cranks. Her dimensions are as follows: Length, 147 ft. between perpendiculars; breadth, 21 ft.; depth, 13 ft. 6 in.; the tonnage is 311, and she is to be fitted up in the most luxurious manner. The engines have three high-pressure cylinders each 7 in. in diameter, working over first intermediate, second intermediate, and low pressure cylinders of 16, 22, and 34 in. diameter respectively, with a stroke of 24 in. The boiler is of steel, of the ordinary tubular type, 9 ft. 10 in. long by 11 ft. 6 in. diameter, and has two Fox's corrugated furnaces 3 ft. 5 in. internal diameter, the working pressure being 180 lb. to the square inch. During the trial of the engines, steam was raised by means of ordinary Scotch steam coal to a pressure of 170 lb. to the square inch, and was kept steadily at that pressure for about an hour before proceeding to the measured mile. On arriving at Skelmorlie, she commenced her progressive trials, and on the full power runs the engines developed a mean indicated horse power of 528, running 113 revolutions and expanding 12 times. After this, further runs were made at reduced speeds to complete the trials. The fires were then cleaned and the coal consumption trials were commenced, the fuel used being Penrikyber Welsh coal. During the first hour, 467 lb. of coal were burnt; the second hour, 468 lb.; the third hour, 456 lb.; being a total of 1,391 lb. for the three hours, or a mean of 463·6 per hour. The mean revolutions were 102·2; the mean steam pressure 170 lb., expanding thirteen times; and the mean indicated horse power 412. This gives the extraordinary result of 1·125 lb. consumption per I.H.P., and shows a saving of 40 per cent over the best compound engines, and of 17 per cent over the best triple expansion engines of similar size. No lubricant was used in any of the cylinders during the whole day's steaming, but notwithstanding this the engine was run as low as 10 revolutions, or a piston speed of 40 ft. per minute. The feed water was kept about 115°, and the vacuum about 25 in. What possibilities lie before the marine engineer, owing to the introduction of quadruple expansion, it is at present too early to estimate; but it seems probable that as the compound engine has, to a large extent, been superseded by the triple expansion engine, so the latter in its turn may have to yield before the latest advance of marine engineering. Messrs. John F. & Matthew Rankin, of Greenock, have for some time past devoted their attention to this department of engineering science, and the result of their labors, in the opinion of many, bids fair to almost revolutionize the modern type of marine engines.

Uniformity in Iron and Steel Axles.

Mr. R. G. Sneath, of San Bruno, Cal., is constantly using about twenty wagons on his ranch, and finds that in buying axles, no two spindles or boxes are quite alike. To remedy the inconvenience, he has settled on wheels of uniform size and on one make of axles. By keeping on hand a few extra wheels, axles, and boxes as nearly alike as he can get, he effects a considerable saving of time for both men and teams. He suggests, therefore, that the different manufacturers shall adopt standard sizes, as few in number and as nearly uniform as possible, for the greater convenience of their customers. The smaller dealers could then carry a better stock, and the demand for iron and steel axles would probably be largely increased.

A SMALL COUNTRY HOUSE.

The tasteful design for a small country house illustrated in the annexed engraving has been erected at Marienthal, near Hamburg, Messrs. Puttfarcken & Landa being the architects. It forms as a whole a neat and appropriate design for that purpose, the arrangement of the rooms being compact and convenient. The rooms are not large—the principal one, or salon, is about 14 ft. × 16 ft., the bedrooms about 14 ft. square, and the other rooms in proportion. As a suggestive design, the illustration, which we take from the *Architektonische Rundschau*, will be found useful. It could be carried out equally well either in brick or stone, with ornamental slate roof, or red brick walls with trimmings of a light stone, and the bay window of the same material would look well.

Manufacture of Swords in Birmingham.

The process of R. Mole & Son is described as follows in the Birmingham *Post:*

Good ore is employed in the shape of ready made steel—Swedish iron which has passed through Sheffield foundries. It comes in what are termed sword moulds—thin bars of steel, which are broadest in the middle, and which, being broken at that point, give each enough material for two blades. Two men are engaged at each hearth, though there are no bellows to blow, the draught being supplied to all the fires by one steam-driven fan, which forces air at a high rate of speed through the cinders. The bar is first heated at the end which will afterward receive the hilt; and a short tongue is beaten out, upon which the tang, or the backbone of the hilt, is welded. Then the whole half-mould is made white hot for the purpose of being swaged or grooved, a process which enables the requisite width and strength of blade to be secured with the minimum of weight. The mould is laid between a pair of convex dies, about two inches long, of which one is fixed in the anvil and the other gripped in a strong pair of pincers. The man who holds the pincers takes care that the dies lie directly over one another, and with a small hammer makes the first impress of each bit of grooving. His companion workman, wielding a heavy sledge, emphasizes and completes it, and the mould is moved along till the groove is finished.

In the process of forging, the blade is brought to the requisite curve. The curve is slight in the most recent swords, with which it is the practice to cut and thrust; but the old saber pattern is still retained by our Indian troops, for whom an order was being executed at the time of our visit. After so much heating the metal has become comparatively soft. It is hardened by being once more heated, this time to a "worm red," and dipped point downward in a tub of cold water. The surface scale falls off, and the blade comes from the water almost white, and exceedingly brittle. It must now be tempered, and the temper is given by a further heating, till from white its color passes in turn to brown, purple, and blue. To truly observe these changes a great deal of skill and care is required, which experience alone can give. From the smith the blades go to the grinding shop, a long shed where twenty men sit astride wooden horses and press them against as many ponderous grindstones, until fierce comet tails of sparks fly off into the air. Like the tails of real comets, these spark sprays are harmless and intangible.

Not so, however, the rapidly revolving grindstones, which from their pace break sometimes into pieces and are hurled away with terrible force. They are so arranged, however, that the fragments must be driven either into the earth, against the under side of the horses (which are firmly secured), or outward and upward, away from the workmen altogether. In case they take the last named direction, they can do no mischief until they have destroyed a massive barrier of beams, which stand sentinel between them and the boiler house, and which is strong enough to more than meet the dispersive shock of the largest of them.

A SMALL COUNTRY HOUSE.

It is the grinder's duty to see that the blade is of the true dimensions and pattern. He fits it into a trough to gauge its length and width, and into several slits in an iron plate to find whether it is of the regulation thickness at various distances from the point. One stone is surrounded with rows of beads or "cobbs," which serve to grind the swage.

The grinding and polishing sometimes slightly impair the temper of the blade, which needs only, however, to be slightly heated again in order to regain what has been lost. The hilt is then fitted on, and is secured in its place by means of plates riveted on each side of the tang, to which also is attached the new finger-piece before referred to. Then comes the important operation of testing the rigidity, strength, and temper of the sword. There are three tests. The blade must be so rigid that it will bear a standard downward pressure without bending, so strong that a man may strike it upon a block of hard wood with all his strength and make no impression on it, and so well tempered that it may be bent without breaking till the distance between point and hilt is reduced from 34½ inches to 29 inches. The fine polish commonly seen upon sword blades is given to them by means of emery wheels and wheel brushes; the blueness of ornamental blades, by heating them in a sand bath; the damascene ornament by the use of acid. They are sharpened in the Government factories.

Sword blades are made much more quickly than their hilts and scabbards. It is upon these, of course, that the artistic fancy of the maker is often lavished, making them, in Osric's words, "very dear to fancy, of very liberal conceit;" and even those hilts and scabbards which are merely made after the regulation patterns consume a good deal of labor in casting and filing. The scabbard of the cavalry sword is shaped from a strip of sheet steel. Placed in an iron book, the strip is bent double, and the two edges are formed into a lap joint and brazed together. It is then planished in a mandrel to the required shape, and is fitted with the loops for carrying it and with the "drag" or tip. In the small matter of the mouthpiece, Mr. Mole introduced an improvement of no small convenience, which did away with the awkward possibility of the sword's point catching as soon as it entered the orifice. The silver scabbards of presentation swords are frequently ornamented with velvet, let into the metal by cutting out portions at each side. Others are embellished with brass mounts, cast and filed like the hilts; and mounts, more or less elaborate, are necessarily put upon leather scabbards. Mr. Mole is now engaged in producing for exhibition at Edinburgh and Liverpool a number of presentation swords. The processes of gilding and nickel plating, as well as those ornamental arts that have already been spoken of, are made tributary to the decorative work.

The firm find that it would not pay to make the manufacture of swords their principal business. So greatly does the demand for swords fluctuate, and so small is the return even in good times, that it is upon matchet making they mainly depend. What a matchet is may be better known in the colonies than in the mother country; and it would not be easy to convey to a person who had never seen one an exact idea of what it is and what it is not. There are more than 150 matchet patterns at Granville Street, no two of which are alike in length, breadth, weight, and configuration. Roughly speaking, the matchet is a large knife, from 24 to 33 inches long, from 2 to 3 inches wide, and so heavy as to bear some resemblance in the handling to a cleaver. It is made of one of the lower classes of steel, but so tempered that the edge when tried with the thumb nail will ring. The handle, which is only large enough for one hand, is made of seasoned beechwood. Though an ugly-looking weapon, something between a scimiter and a bowie knife in appearance, its use is entirely pacific. It serves admirably for cutting grass crops, clearing brushwood, or dressing trees; indeed, it is a generally useful tool, without which the colonist would be in a sad plight. Yet Mr. Mole manufactures it for the ridiculous average price of 6d. or 8d.! It is not surprising that at such a figure he should sell 500 dozen every week—that is to say, four tons weight—or that the judges at the recent Inventions Exhibition should have awarded him an additional gold medal in consideration of its cheapness and serviceableness.

To increase the tenacity of filtering paper, Francis draws it through nitric acid, sp. gr. 1·42, and immediately washes with water. When thus treated, filtering paper shrinks somewhat and weighs slightly less; it can be washed and rubbed just like linen without losing its filtering properties. A strip of ordinary filtering paper 25 millimeters wide could not support more than 100 to 150 grammes, while a strip treated with nitric acid supported 1·5 kilogrammes.—*Pharm. Zeit.*

A NEW FRUIT DRIER.

A compact and portable fruit drier, adapted to the wants of farmers and others desiring to produce a good article of dried fruit, is shown in the annexed engraving. The inventor informs us that the device dries apples in a few hours, delivering the fruit white and clean, with all the flavor retained, so that it resembles in all respects the article sold as evaporated fruit.

The case, A, has a number of openings in its front side, for a series of movable drawers for containing the fruit to be dried. The case has a furnace chamber, B, in which is placed a movable sheet iron furnace having a cast iron bottom provided with a handle, *j'*. The upper part of the furnace sets loosely on the bottom, and is easily removed to facilitate the discharge of ashes. Charcoal or coke makes the best fuel, but coal from the kitchen fire may be used if the bituminous matter is permitted to burn out first.

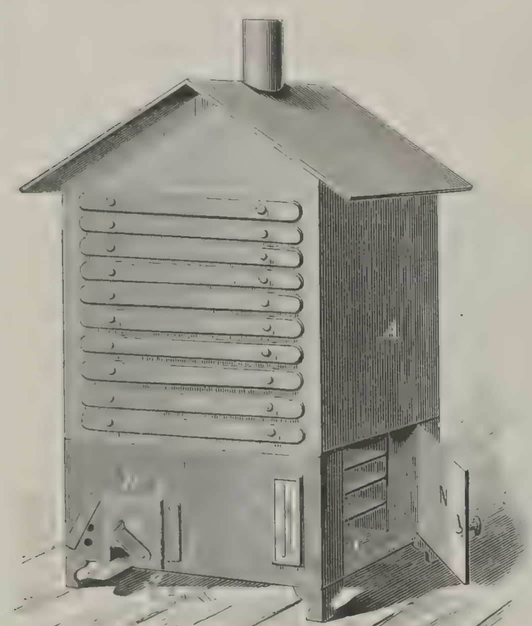
The draught of the furnace is regulated by the damper, *m*, and the admission of air to the furnace chamber is controlled by dampers, *j*.

A purifying chamber, C, separated from the furnace chamber by a perforated partition, has shelves or trays containing absorbents by which impurities are removed from the gas and hot air that proceed from the furnace chamber. From the purifying chamber the hot air and gases are drawn upward over and under the several fruit-containing drawers in alternation, and are finally discharged through the flue at the top, carrying with them the moisture from the fruit.

The temperature of the air in the purifying chamber is indicated by the thermometer seen at the right, and the draught may be regulated to give any required temperature

The drier shown in the engraving is thirty six by twenty inches, and the drawers, ten in number, are about three fourths of an inch deep. Such a drier will contain about two bushels of fruit.

The device may be made small and portable, or it may be adapted to a fixed building.



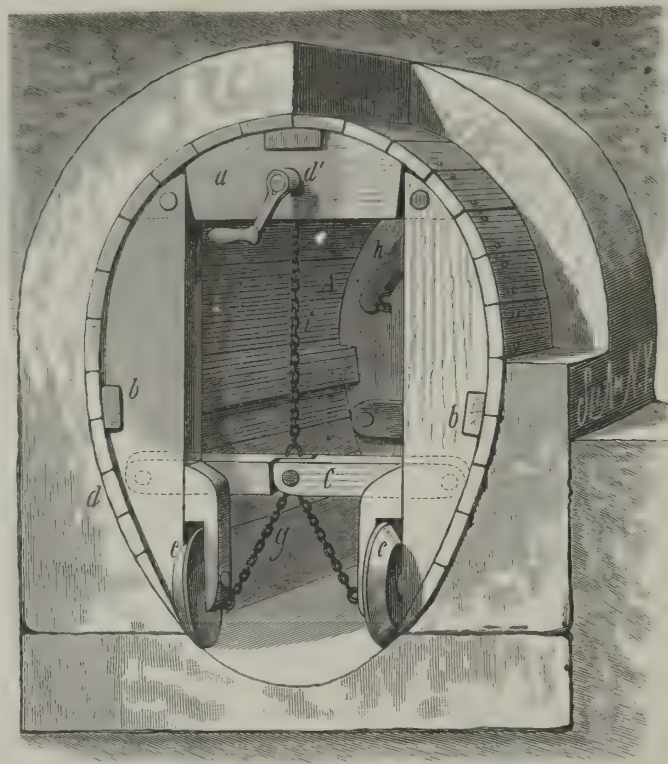
MUMBRUE'S FRUIT DRIER.

This fruit drier is the invention of Mr. William B. Mumbrue, of Montour, Iowa.

IMPROVED ROLLER GATE.

The annexed engraving represents an improved apparatus for operating roller gates, recently patented by Mr. Henry Allen, of Silverton, Oregon. The invention consists in the application of an endless chain or rope to a double or single roller gate, the rope being provided with handles and conveniently arranged so that the gate may be opened by pulling the rope in one direction, and closed by pulling it in the other direction.

The engraving shows the application of this device to a double rolling gate, but it may be applied with equal advantage to a single one. The gates run on a horizontal bar supported by posts which also support a protective covering. Two posts, set up on opposite sides of the gate, and equally distant from it, support pulleys around which passes the endless rope, A, which also passes around two pulleys on one of the gate posts and one pulley on the opposite post, bringing two strands of the rope above the gates in a horizontal position. The lower strand has a strong loop through which passes an arm projecting upward from one part of the gate. This loop is of sufficient length to admit of moving the rope a short distance without moving the gate. The upper strand of rope is connected with the other part of the gate by a three-armed lever, D, which is pivoted to an arm projecting upward from the gate. The lever, D, is connected with the gate latch, and the first operation on pulling the rope is to unfasten the gates; a further movement of the rope opens the gate. A person in a carriage or upon horseback may readily open the gate by grasping the handle, B, and drawing it along as he proceeds. After passing through the gate the handle, C, is grasped and the gate is closed. The operation of the gate is the same whether approached from one direction or the other.



BURNS' MOULD FOR SEWER BUILDING.

IMPROVED MOULD FOR SEWER BUILDING.

The annexed engraving represents an improved mould or centering, used in sewer building, and is adapted to any of the sewer building materials in common use, such as concrete, artificial stone, or brick, and is made of convenient length and of the proper form for a sewer, and is mounted on wheels and made collapsible, so that after a section of sewer is built it may be contracted and moved into a convenient position for building another section.

The frame of the mould consists of a top cross rib, *a*, at each end, to which are pivoted vertical side ribs, *b b*, having their lower ends connected by toggle bars, *c*, which retain and brace the ribs, *b*, when the mould is expanded. The ribs, *a b*, are covered by a sheathing, *d*, of wooden slats or sheet metal, except at the bottom, which is left open. Extending lengthwise through the mould, and sustained by ribs, *a*, there is a shaft, *d'*, from which chains or ropes, *i*, extend to the jointed bars, *c*. The shaft, *d'*, project beyond the ends of the mould, and is provided with crank handles, by which it can be turned to wind the chain, and thereby draw the sides of the mould inward.

The mould is supported on wheels, *e*, fitted in supports at the lower ends of the side ribs. These wheels facilitate the labor of shifting the mould as the work progresses.

In building sewers with this mould, a bottom or base, of stone or concrete, is first laid in the trench at the required grade, and when this is set the mould is placed thereon and the sides and crown of the sewer formed around it. A head is attached to the end of the mould by screws or other fastenings, and projects as a flange, serving as a gauge for the thickness of the wall. When the section is completed the head may be removed and the shaft, *d'*, turned to draw the sides of the mould inward. This action allows the mould to drop down, so that the sides and crown are relieved, and the mould may be then drawn out to the position required for the next section, and expanded by relieving the chain.

Springs, *g*, attached to the bars, *c*, and ribs, *b*, tend to draw bars, *c*, downward and expand the mould. There are also braces, *h*, hung on the ribs, *a*, which, when the mould is collapsed, catch on pins in side ribs, *b*, giving rigidity to the mould while it is being withdrawn.

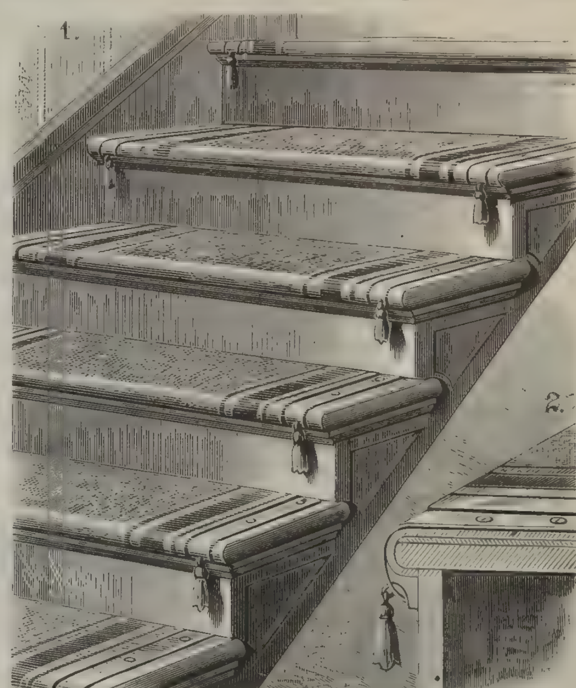
To prevent the sides of the mould from being forced inward when the sides of the sewer are rammed, the joint of the bars *c*, are fitted to drop slightly below the center line when the sides are expanded, and the springs, *g*, aid in accomplishing the same object. By the use of this mould a sewer may be built rapidly to any grade, with top and sides of uniform thickness, without joints, and with a smooth interior surface. The trench may be filled as the work progresses up to the crown of the sewer, and the side walls thus strengthened while the material is setting.

This invention was recently patented by Mr. James Burns, of San Antonio, Texas.

Poodle Motors.—At the recent Applied Science Exhibition, Paris, M. Richard, a clothier, exhibited a motor which was turned by a poodle dog, confined in a revolving cage. The dog was able to drive four sewing machines. Women who have heretofore been accustomed to support their poodle dogs in idleness may now make them useful.

NOVEL METHOD OF CARPETING STAIRS.

We give herewith an engraving of a new method of carpeting stairs recently patented by Mr. T. F. Walter, S. E. corner 20th and Brown streets, Philadelphia, Pa. Instead of a continuous carpet extending from the top to the bottom of the stairs in the usual way, each step is provided with its own carpet, which may be put on or taken off independently of the other steps. These sections of carpet are secured to the steps at the rear by tacks, and at the front by the moulding under the nosing. A band of brass or other metal, either plain, ornamented, nickeled, gilded, or enameled, extends across the ends of the carpet, and curving over the nosing is furnished with a metallic pendant.



WALTER'S METHOD OF CARPETING STAIRS.

Stairs carpeted in this way present an elegant appearance, and accord with the modern style of house furnishing. The carpeting is adapted to stairs of all widths, and little more than half the usual quantity of carpeting is required. The rods, while costing less than the ordinary styles, are much more ornamental and secure. There are several other advantages in this style of carpeting which will be apparent to those interested in this subject, not the least of which are the doing away with the use of covering to hide worn places that would otherwise appear when the carpet is moved up or down, and the facility with which any or all of the small pieces may be removed from the stairs and cleaned.

ALLEN'S IMPROVED GATE.

THE NEW PARLIAMENT HOUSE, VIENNA. Drawn by L. E. Petrowitsch.

Scientific American.

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THE

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CONTENTS

Of the May number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

A COUNTRY HOUSE.

General Remarks.—Our plate this month illustrates a country house built in 1884 at Glen Ridge, N. J., Renwick, Aspinwall & Russell, architects, New York. Cost, complete, $5,200, with plumbing, range, and furnace. Hard wood floor on first story. All the floors are double, and have heavy felt paper between them. Cellar under the whole house. Besides the rooms on the second story, there are two finished rooms in the attic, also a tank room, store room, and open attic. The frame of the house is of spruce, filled in with 2 x 4 studs set 16 inches from centers, is all rough-sided, with one inch hemlock boards and rosin-sized paper, and finished on first story with clapboard, and shingles on the second story. The roof is of slate, and water caught from the same and turned into tank or cistern. The cistern and cesspool are also included in the above price. The woodwork of the inside is of white pine stained and varnished on the first and second stories, and all other woodwork inside and out is painted three coats. The grading of the grounds only cost some $75.

SPECIFICATIONS.

Excavating.—Do all excavating necessary for cellar, trenches, piers, privy vault, cesspool, etc. Earth graded about building. Cart away mason's rubbish. Excavated material graded around the premises. Outside of foundations cemented.

Foundations.—Start walls 6 in. below cellar bottom, and carry up same 18 in. thick, with good quarry stone, laid in cement and sand mortar, plastered outside one coat cement mortar. Build area wall up to grade, same thickness. Put down foundations under piers, 2½ ft. deep of concrete.

Brickwork.—Build up chimneys with fire-places and flues as shown, joints in flues and kitchen fire-places struck. Turn arch over kitchen fire-place, and trimmer arches to all fire-places. Put in three earthenware stovepipe collars with tin covers. All brickwork to be laid up with hard Jersey brick in cement and sand mortar. Partition walls in cellar of brick 8 in. thick.

Drains.—Lay 4 in. vitrified earthen drains from house to cesspool, situated 30 ft. from rear of building, also from leaders to gutter, all joints thoroughly cemented, to be laid 2 ft. below grade. All pipes to be submitted to architect before being covered. Also lay 6 in drain from leaders to cistern, as shown on plans.

Bluestone.—Cellar window sills 3 in. thick, cesspool flag 2 ft. x 2 ft., chimney caps 2½ in. thick, kitchen hearth 1'6 x 4'0. The above to be of sound blue quarry-dressed stone. Area steps 10 in. wide, set with brick risers. Coping on area walls bedded in cement. Cellar piers to have bluestone caps 3 in. thick size of piers.

Cellar Bottom.—To be leveled off and concreted 3 in. thick with cement, sand, and gravel, floated off on top.

Lathing.—All lath used must be the best St. John spruce lath, laid one-quarter inch apart, with 4 nailings to the lath and joints broken every 18 in., no lath put on vertically. Back of all chimneys to be lathed and plastered.

Plastering.—All walls and ceilings in 1st, 2d, and 3d stories to be plastered three coat work in the best manner, closets and attic one coat and skimmed. Cellar ceiling to be lathed, and plastered one heavy coat plaster. All plaster to extend down to the floor. Scratch and brown coats composed of clean sharp sand, goat hair, and lime. Lime run through sieve, hard finish composed of lump finishing lime, plaster, and white sand. All walls, ceilings, and angles to be perfectly straight, true, and level, browning kept well up to grounds. Patch up after other mechanics, and leave plastering in complete order on completion. Finish arch with beads in angles. Put up three centers. Furnish rough material for setting range grates, hearths, and tile.

Cesspool, etc.—Build cesspool 6 ft. diameter, 8 ft. deep in the clear, and privy vault 4 ft. x 4 ft. x 4 ft. deep, both with 12 in. dry stone walls. Privy vault to have two courses brick on top laid in mortar. Cesspool to have bluestone octagon flag 3 in. thick with iron cover.

Whitewashing.—Stop-point and lime-whiten the walls and ceiling of cellar.

Deafening.—Fill in with mortar the floors of all bay windows and projections that extend out beyond cellar.

Cistern.—Build a cistern 8 x 8 ft., 4 in. brick walls and bottom, arched over at top with manhole, cistern to be cemented tight, and warranted tight for one year. Cistern covered with octagon flag 2 ft. x 2 ft. square, with iron cover. (If the place is supplied with water from waterworks, no cistern will be required.)

Timber.—Sill and corner posts 4 x 6, entertie tie-beams and plates 4 x 4, girders in cellar 4 x 8. Each tier beams 2 x 9 inches, 16 inch centers, double for trimmers and headers, tail beams mortised into heads. Rafters 2 x 6, 2 foot centers, hips and valleys 3 x 7 inches. Piazza sills 3 x 6 inches, 2 x 6 timbers, 2 foot centers cut in between. All studding 2 x 4 inches, sixteen inch centers, doubled at openings, and partitions set with sill and plates. Framing to be done in the best manner, well nailed and stayed. All timber to be of sound and thoroughly seasoned white hemlock, free from shakes and other defects. All partitions to be thoroughly braced, each tier of beams to have two rows of herring bone bridging.

Furring.—Do all furring required to lath, to furr off under side of all stairs, and form segment arches where shown. Furr off attic for breast and first story stone wall.

Inclosing.—The entire frame from sill to plate, including roof, to be inclosed with hemlock boards, squared edges, covered with Eureka sheathing paper and (except gables) clapboarded with No. 1 beveled 6 inch clapboards, well lapped, carefully nailed, nails set. Gables, tower, and belt to be covered with sawed pine shingles to be cut ornamental.

Shingles, etc.—All roofs to be shingled with 18 inch sawed white pine shingles, best quality, nailed to 1 x 2 spruce shingle lath.

Outside Trimming.—Water table 1¼ inches x 6 inches, beveled on top and tongued for siding. Corner boards 1¼ inches x 3 inches. Belt courses 1¼ inches by 3 inches. Moulded cornices, and gutters built in cornices. Eaves of seven-eighths inch narrow matched and beaded white pine. All details to be made as per working drawings of second quality seasoned white pine, free from loose knots or sap.

Floors.—1st, 2d, and 3d story floors laid with first quality narrow white pine flooring, 5½ inches wide, blind nailed. Two nails to each bearing. Do all cutting away for plumbers and other mechanics. Piazza flooring first quality narrow pine, free from sap, and joints leaded. No butt joints.

Windows, Window Frames, Sash and Blinds.—Plank frames for cellar windows as usual, one and a quarter inch sash, American glass. Outside casing 1¼ inches x 3 inches, jambs 1¼ inches, parting strips ⅝ inch by ½ inch, outside stops 1¼ inches x ¾ inch, inside stop ⅝ inch. All other sash 1½ inches thick, glazed with first quality French sheet, hung with hempen cord, iron weights, and iron axle pulleys; sash secured with patent window fastening. Sash made of seasoned white pine, oiled. Casements sash to have domestic fasteners, stained glass where shown to cost $1.60 per square foot. All windows to have 1¼ inch outside blinds, rolling slats, hung with malleable iron blind hinges and strong fastenings, to be painted two coats by blind maker. Inside Venetian blinds in bay windows.

Doors, Hardware, etc.—For height, width, and thickness of all doors, see plans. Front door glazed in upper part with rolled cathedral glass. Doors made of seasoned clear white pine free from all knots and stains for oil finish. Sliding doors, 2 in. thick; closet door, 1¼ in. thick; other doors, 1½ in. thick. All four-panel. Drawers underneath counter shelf in pantry to have locks. All casement sash to hang with iron butts to open out, and secured with the Domestic Fastener and Adjuster, outside cellar door and all batten doors hung with T hinges, cellar door to have padlock. All double hung sash to have 2 inch patent axle iron pulleys, iron weights, and best hemp cord, secured with the patent sash lock. All doors to have ⅝ inch beveled saddles of ash. Hardware will be of the patent bronze first floor, balance porcelain. 3 in. x 4 in. mortise lock, 3½ loose butts. Improved sash fastenings. Front door to have night works complete. All necessary clothes hooks.

Stairs.—See details. To have 6 inch newel, turned ball on top, angle posts 4, chamfered and pointed both ends, 2 inch x 3 inch moulded rail, 1½ inch turned balusters, all of seasoned ash, well cleaned down. Treads and strings 1¼ inches, 12 inches wide, risers ⅞ inch, 7½ inches high. Nosings and cove returned on strings. All glued, blocked, and wedged, and to have 2¼ inch x 4 inch carriages. Stairs to attic to correspond to main stairs, all pine, to have 1 inch treads, strings, and risers. Stairs to be got out of seasoned white pine, made and put up in a substantial manner. Put up smooth pine steps to cellar, and 1¼ inch pine treads and strings.

Inside Casings.—All inside doors to have 1 inch jambs with ½ inch moulded strip to form rabbet, all well blocked for hinges. All doors and windows to have ⅞ inch beaded casing 5 inch wide, as per detail, with back moulding, closets and attic ⅝ inch plain casing 4 inch wide. All windows trimmed on to moulded stools with 3 inch beaded aprons below. The above trim for parlor and sitting room and hall to be of seasoned white pine, smooth and free from knots or other defects, for oil finish, first and second floors; painted in attic.

Base.—In 1st and 2d stories, except closets and kitchen, put down plinths 8 inch high, beaded same as trim, and one base moulding, all scribed to floors and well nailed, and of same quality and kind of lumber as trim. Attic base plain ⅞ inch x 6 beaded.

Angle Beads.—All plaster angles to 1½ inch turned angle beads.

Closet Work, etc.—Put up 2½ inch strips for wardrobe hooks, where directed. All shelves put up on strong rebated cleats; shelve closets as follows: All closets to have two rows of shelving and one row of japanned double hooks. Butler's pantry fitted up with counter shelf 20 inches wide below, with three drawers underneath on one side and two doors on

opposite side, with sash doors to slide above. In kitchen, wainscot above sink two feet high around to window neatly capped, to be done with ⅞ narrow matched and beaded pine. Put drain shelf to sink. Bath room wainscoted 3½ feet high on all sides with ⅝ inch narrow matched and beaded white pine capped, front of tub, W. C. & W. B., same closet under W. B., door hung and secured with button, cap of tub, seat and lid and W. C. one 1¼ inch stuff; lid hung on brass hinges. Build coal bin, capacity 10 tons, in cellar, also pantry in cellar as directed.

Rear Piazza and Bay Window.—Round off flooring and front edge, and finish with cove and facia. Fill in between piers with ¼ x 1½ inch lattice. Plate 2 x 3 inch let into posts, finish under plate over doorway with 1½ inch rail, moulded, finished with clapboards. Form moulded gutter in cornice, ceilings boarded with ⅝ inch narrow matched and beaded pine, shingled as per main roof; steps same as floor, and strings 1¼ inch; risers ⅞ inch. Rear porch to have strong floor timbers, 1 inch floor, steps and risers, not inclosed, roof of same shingled, and supported by brackets or posts.

Mantels.—Will be provided by the owner; must be put up by carpenter.

Clothes Posts.—Furnish and set for house four chestnut turned posts; set 3 ft. in the ground.

Privy.—Four and a half feet square, double faced matched boards, battened, shingle roof, plain spruce frame, ceiling overhead, battened door with thumb latch and bolt, 4 light sash, strong floor timbers, wide floor, seat with two holes, 1 child's seat, lids chamfered and hung. Build outside cellar doors complete. Build two wash trays of 2 in. lumber with lids and legs complete, lids hung on brass hinges; inside measurement of tubs to be: depth, 16 in.; width, 22½ in.; length, 26½ in high; supplied through nickel plated patent cocks, to have plug, chain, etc., complete. Furnish, fit up and connect one wash out water closet with white earthenware bowl, and drip porcelain supply tank above.

Painting.—Outside woodwork to have two coats of best Atlantic white lead and linseed oil in three colors, roof stained. Interior, one coat of filler and one coat of hard oil.

Tinning and Plumbing.—Furnish all necessary flashings for windows, valleys, etc., line gutters, and do all tinning required by the drawings, also furnish and put up 3 in. tin leaders where shown. Supply pipes, AA, ⅝ lead.

Waste.—Run 4 in. cast iron soil pipe from drain, at least 3 ft. outside cellar wall and 4 ft. above roof, finished with ventilator. To have necessary branches, etc., joints calked with molten lead; sink, bath and wash bowl waste through 1¼ in. D pipe. Sink and wash bowl to have S traps with screws. Bath waste to run to water closet trap. Sink waste to drain into main pipe at cellar. All pipes to be thoroughly tacked to boards and between beams packed with mineral wool. Plumbing to be guaranteed for one year. Two wash tubs and connection in kitchen, with hot and cold water with waste.

Gas Fitting.—Run all necessary gas pipe of suitable size for outlets as shown, and in accordance with rules and regulations of the gas company.

Bell.—At front door 4 in. gong.

Furnace and Range.—Furnish and put up in cellar one portable furnace complete; pipes running through floors to have tin collars and be well protected where required, to have tin register boxes, casings, and black japanned registers, with frames set in walls where practicable. Furnish and set in kitchen a range with water back complete.

Plumbing.—Connect with city water in cellar and run ⅝ in. AAA pipe throughout for all connections. (If no city water, line a tank 6 ft. x 4 ft. x 4 ft. in attic to supply bath, sinks, boiler, closets, and tubs.)

Kitchen.—Furnish and set in kitchen one 18 x 30 cast iron sink with legs, supplied with hot and cold water through ⅝ in. patent brass cocks. Furnish and set one 30 gallon galvanized boiler connected with water back of range. Put in sediment cock to boiler. Run circulating and escape pipe from boiler.

Pump.—Furnish and set complete a Coleman ship pump in kitchen, supply tank from cistern also direct to sink. (This pump is not necessary if city water is used.)

Bath Room.—Furnish and set one 5½ ft. 14 oz. French pattern copper planished overflow tub, supplied with hot and cold water through ⅝ in. nickel plated patent cocks, to have nickel plated plug, chain, etc. Furnish and fit up 14 in. marble style overflow basin, 1¼ in. moulded and countersink slab 1 in., moulded base, 6 in.

A DISPATCH from Penn Haven, Pa., says: "A rock weighing probably 8,000 tons fell upon the Lehigh Valley track near here, narrowly missing a train. It will have to be blasted away by dynamite. Meanwhile tracks have been laid around it, and trains are running as usual. The rock has hung from the mountain side for twenty years, and has been an object of interest to tourists. The heavy rains dislodged it."

THE NEW HOUSE OF PARLIAMENT IN VIENNA.

By removing the walls that formerly surrounded the center or old part of the city of Vienna, an enormous tract of land was made available as building plats, and the Austrian Government, as well as the municipality and citizens of Vienna, have availed themselves of the opportunity of making the city one of the finest in the world by erecting ornamental and handsome edifices on the Ring Strasse, which forms a circle in the heart of the city, in place of the old fortress walls.

Among some of the handsome buildings erected here are the Votive Church by Ferstel, the Museum of History and the Museum of Natural Sciences by Semper and Hasenauer, the University, in the Renaissance style, by Ferstel, the Gothic Town Hall by Schmidt, the New Court Theater, and finally the new House of Parliament, designed by and erected under the supervision of the well known architect, Theophil von Hansen. Von Hansen has made the Greek style of architecture a specialty, and by his last great work, the above mentioned House of Parliament, he has given ample proof that a building of this kind can be erected as well in the Grecian style of architecture as in the Renaissance and Gothic, which styles have usually been employed in such buildings heretofore.

The new House of Parliament is 468 feet long and 449 feet wide. The building is only one story high, but is provided with a very high sub-story or basement of rustic masonwork, which gives the entire building a massive and imposing appearance. In the middle of the building a grand portico crowned by a pediment is erected, which contains twelve columns arranged in two rows, the columns being 40 feet high. At both sides of the portico, wings are erected, the facades of which are formed of upright columns supporting the entablature, between which columns windows are arranged. The end pavilions are each provided with a portico supported by six columns, and behind the same square buildings are erected, which are crowned by atticas ornamented with sculptures and figures. The corners are highly ornamented by means of reliefs, and support bronze chariots drawn by horses, which are driven by Goddesses of Liberty occupying the chariots. At each end of the building a porte cochere supported by caryatides is arranged. In the above mentioned square buildings the two assembly halls are located, one for the House of Lords and the other for the House of Representatives. In front of the building two curved inclined approaches are arranged, which lead from a point near the end pavilions to the central portico and serve as carriage driveways. The columns and ornamentation on the front are all in the Corinthian style, and the outer appearance of the buiding is so arranged that it distinctly shows the arrangement of the interior.

In the central part of the building, the front of which is formed by the portico, is a vestibule corresponding to the pronaos of the Greek temples, which contains the staircase which leads to the first story from the sub-story. Beyond the vestibule a grand hall for state festivities is arranged, which is decorated most lavishly. It is a temple 134 feet long, 75 feet wide, and 41 feet high; the roof is supported by two rows of twelve columns, each 29 feet high, and consisting of a monolith of red marble provided with a gilt capital. The columns form a passage 23 feet wide around the hall in the same manner as in a hypaethral temple. The walls are covered with bluish gray Pavonazzo marble, and the floor is formed of polished light gray tiles, each surrounded by a red border. The columns support a highly ornamented lacunar ceiling, provided with numerous sky-lights, and the naos is provided with a glass roof ornamented with ivy branches, which is a substitute for the open naos of the Grecian temples. Below the ceiling is a frieze 328 feet long, painted in encaustic colors on a gold ground, representing the history of mankind. The beauty of the proportions, the brilliancy of the material, and the combined influences of the design in general and the beauty of execution produce an effect that is grand and marvelous This central hall forms the heart of the structure, and is to be used for state occasions, for instance when the Emperor is to meet the Peers and Representatives, etc.

The halls for the Peers and Representatives are arranged as semicircular amphitheaters; the straight wall behind the president's chair or desk is ornamented by porticoes of Ionic columns, between which niches and spaces for pictures and statues are arranged; the semicircular side is provided with two galleries supported by eighteen Hermes of white marble. Each hall is provided with a glass roof, the roof in the hall for the Representatives being ornamented, but the hall of the Peers is left plain, according to their wishes.

Besides the above mentioned rooms, reading rooms, restaurants, libraries, and other rooms for clerks, etc., are arranged in different parts of the building. All parts are painted or otherwise ornamented in color. Mr. Hansen desires to give the facade throughout a polychromatic ornamentation, but it is doubtful whether his wishes will be carried out or not. Several parts of the front have been ornamented in this manner, and seem to verify his statement that the building will be complete, and will produce the effect desired, only when provided with this polychromatic ornamentation.

The cut given on page 197 is taken from the *Illustrirte Zeitung*.

Practical Directions for Lightning Rods.

As the season of thunder storms is not far distant, a few practical directions for lightning rods may be found useful.

Quarter inch naked copper wire, such as is used for street electric lights, will do for the rods. Two of such rods are better than one, each rod to be continuous, or if jointed, the joints to be soldered.

Run the upper end of rod around the edges of the chimney and the peaks and edges of the roof; bend so as to leave a looped point at each corner; points to be 6 inches high. Fasten the rod directly to the exterior of building with staples, no insulators. The bottom of each rod should be wound around the metallic street water pipe (or gas pipe, if there is no water pipe). Better solder the rod to the pipe.

By means of branch wires or rods connect the lower ends of the water leaders, also one end of each metallic gutter, also all metals and metallic roofing, if any, with the rod; solder the connections, and run rod to ground and around the water pipe, as before stated. Several separate rods may be used. The more the better, if properly grounded.

The essential rule of safety is to have the rods well connected with the earth. For this reason soldering to the underground water pipe is advised.

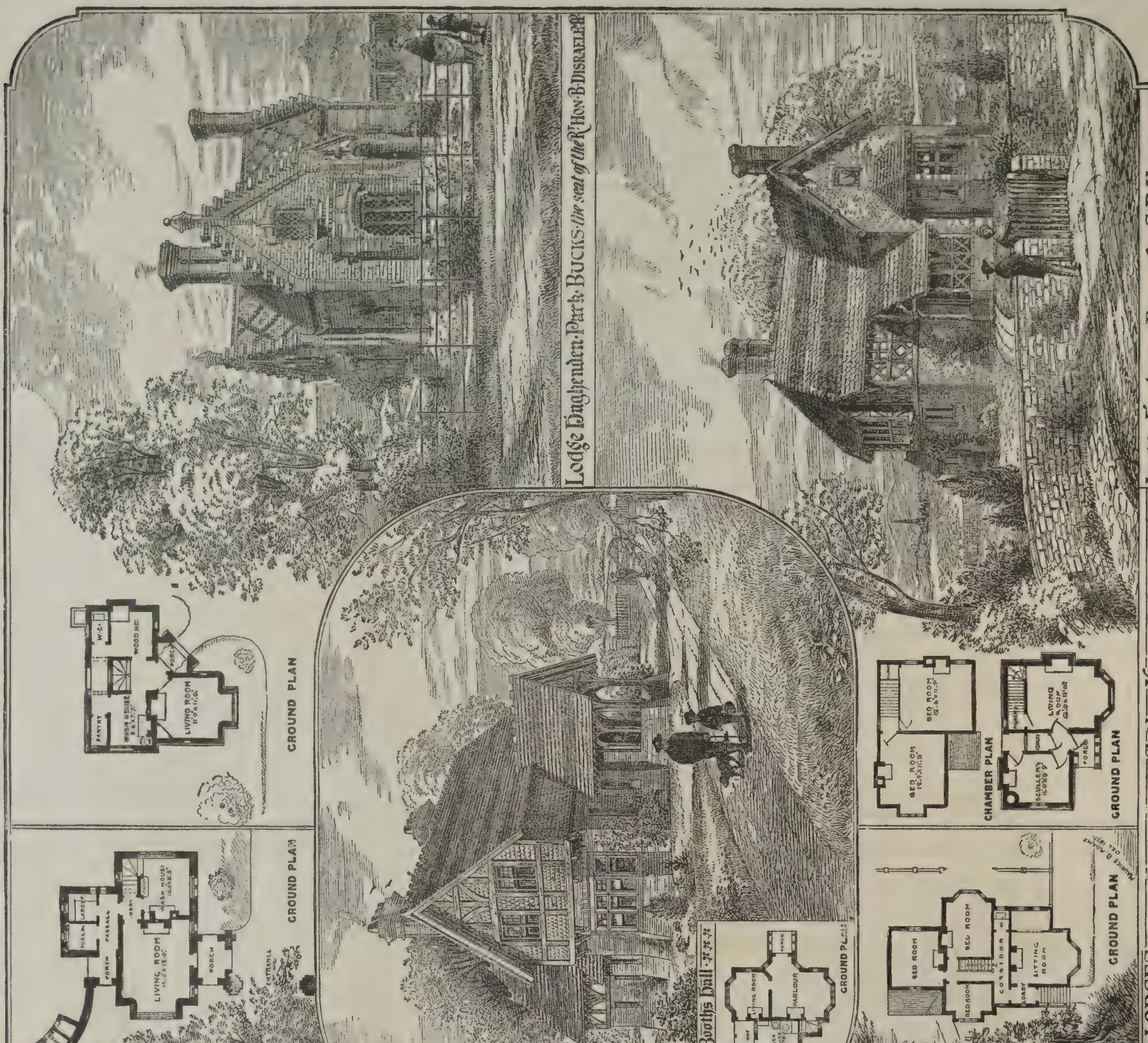
If no metallic water pipes or gas pipes exist, then dig a very narrow trench four feet deep, cone-shaped bottom, and fill into bottom a continuous layer of coal dust and lay the rod therein. Any kind of coal dust, charcoal, hard or soft coal will do. The trench with coal dust layer and rod therein should be say 100 feet long. Coal is an electrical conductor. The object of placing the lower end of the rod therein and extending the rod so far is to secure good ground conduction and connection for the rod.

The great majority of rods now erected are deficient in their ground connections, and consequently are practically useless. This is the reason we hear of so many instances of damage, even when buildings have rods. In general, the rod is simply stuck down two or three feet deep into dry earth, which is about the same as if the lower end of the rod were inclosed in a bottle; such rods are fatally defective. Now is the time to look to your rods. Correct the main defect by making a first-rate ground connection, as above described, or take down your rod. The only chance for safety is with a good ground connection. The risk of damage is less without a rod than with one badly connected to the earth.

Finally, be it remembered that good lightning rods, well connected with the ground, are of unquestionable value in protecting life and property. There are thousands of instances where rods have safely conducted the electrical discharge. We believe there is no authenticated example in which a properly made and properly connected rod has failed to give protection.

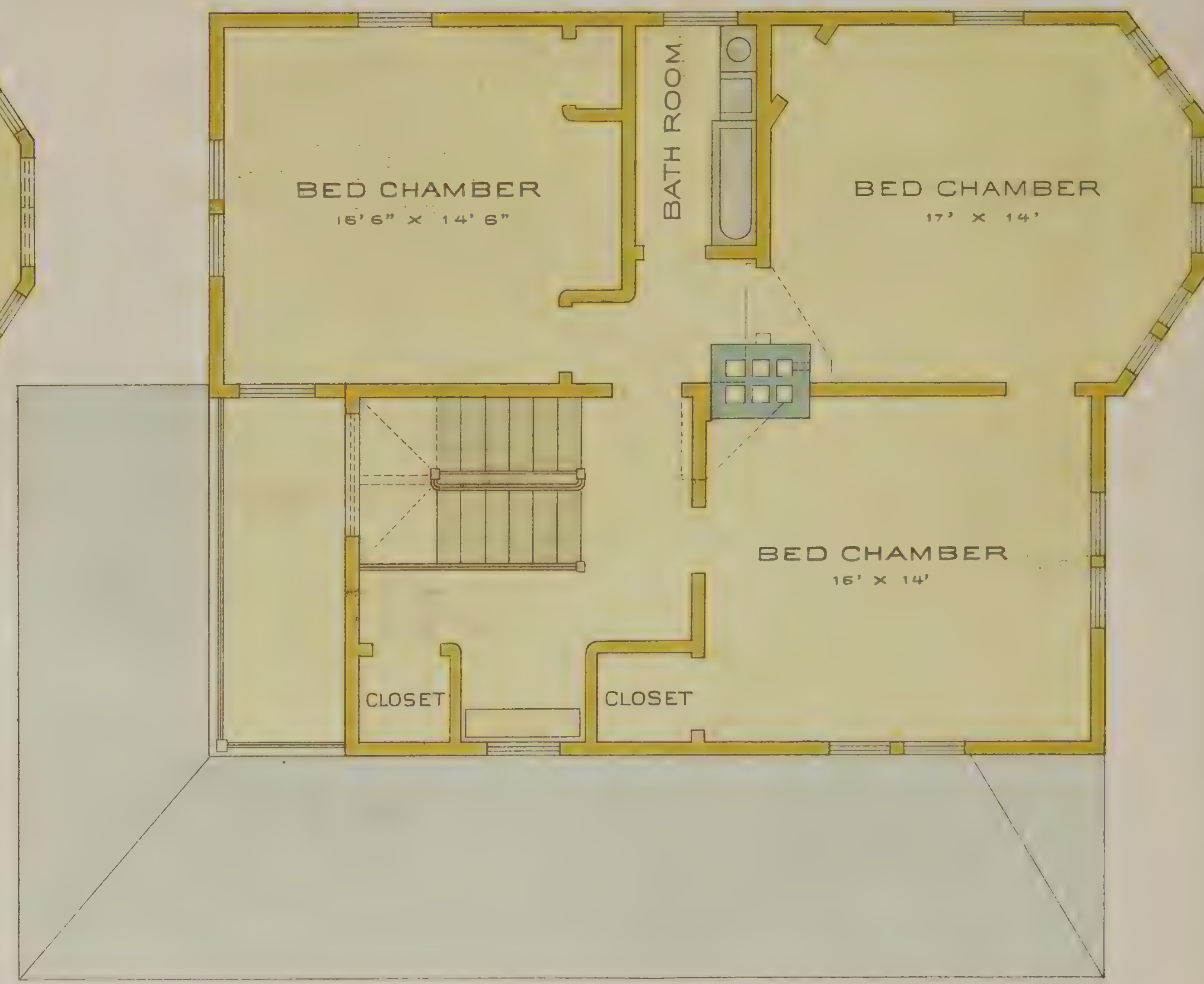
Utilizing Milkweed.

A writer in the Providence *Journal* predicts a useful future for the milkweed, which has heretofore been considered only a cumberer of the ground. Its seeds yield a finer oil than linseed; its gum can be used in place of India-rubber; and from its floss a fabric resembling Irish poplin has been made; while the young shoots are used in the spring by some people instead of asparagus, which they resemble in flavor. Now, pertinently adds the writer, if uses can be discovered for the thistle and whiteweed, they may prove friends in disguise.


Lodge Hughenden Park Bucks the seat of the Rt Hon. B. Disraeli M.P.
Lodge Hazlemere Bucks for G. D. Heatley esq
Arthur Vernon ARCHT High Wycombe
ENTRANCE LODGES
Lodge Wooburn House Bucks for A. Gilbey esq
Lodge Loudwater Bucks to "Rayners" the seat of Sir P. Rose Bart
Lodge Norbury Booths Hall Knutsford Cheshire
GROUND PLAN
CHAMBER PLAN
LIVING ROOM
BED ROOM
SITTING ROOM
PARLOUR
SCULLERY
PORCH
PANTRY
WASH HOUSE
ENTRANCE


SCHUMACHER & ETTLINGER, N.Y.

FIRST STORY PLAN.



SECOND STORY PLAN.

HOUSE AT GLEN RIDGE, NEW JERSEY.

SCHUMACHER & ETTLINGER, N.Y.

SMALL COTTAGES.

We give on the opposite page a selection of cottages built from designs by Mr. Arthur Vernon, architect, High Wycombe, some of which will doubtless be found interesting and useful to our readers. The *Building News* says:

"*Lodge, Hughenden Park.*—This building was erected for the late Mr. Disraeli, then the Prime Minister. It forms the principal entrance lodge to Hughenden Park. In design it is intended to correspond somewhat with that of the mansion, and the materials—of brick with stone dressings—are similar. The lodge contains six rooms, and, to avoid unsightly outbuildings, all necessary office accommodation is also arranged under the same roof. From its site there is an extensive view of the Hughenden Valley and the sylvan charms of the park and manor house which have been so long associated with Mr. Disraeli's name.

"*Entrance to Rayners.*—From the London and Oxford road this lodge, with the gateway, forms the principal entrance to Rayners, Bucks, the seat of Sir Philip Rose, Bart., which is on the summit of the Penn Hill, about two miles distant. The lodge contains three good bedrooms, parlor, kitchen, and ample offices. The materials are of white Suffolk bricks in the dressings, with axed flintwork panels, and ornamental bricks, of Pethers' patent designs, freely used in the strings, arches, cornices, etc. The roofs are covered with Broseley dun-colored tiles, surmounted by Macfarlane's iron ridging.

"*Wooburn House Entrance Lodge.*—This lodge is a large rustic building serving the double purpose of a gatekeeper's house or a summer residence for visitors. It contains ten rooms, some being of ample proportion, the position and half sunk basement giving it, however, the appearance of a smaller size than it really possesses. The basement walls are of thick brickwork, and the structure over is of rustic firwork, with felt and boarding inside and battened. The roofs are of thatch. It has been lately erected for Alfred Gilbey, Esq., adjoining the high road from Wooburn Green to Marlow.

"*Entrance Lodge, Hazlemere.*—This building is placed at one of the entrances to Hazlemere Lodge, near High Wycombe, Bucks, the property of G. D. Heatley, Esq. It occupies an exposed position on the hill-top. The materials are flint and white bricks, with slated roof and widespreading eaves. The lodge contains six rooms and outbuildings.

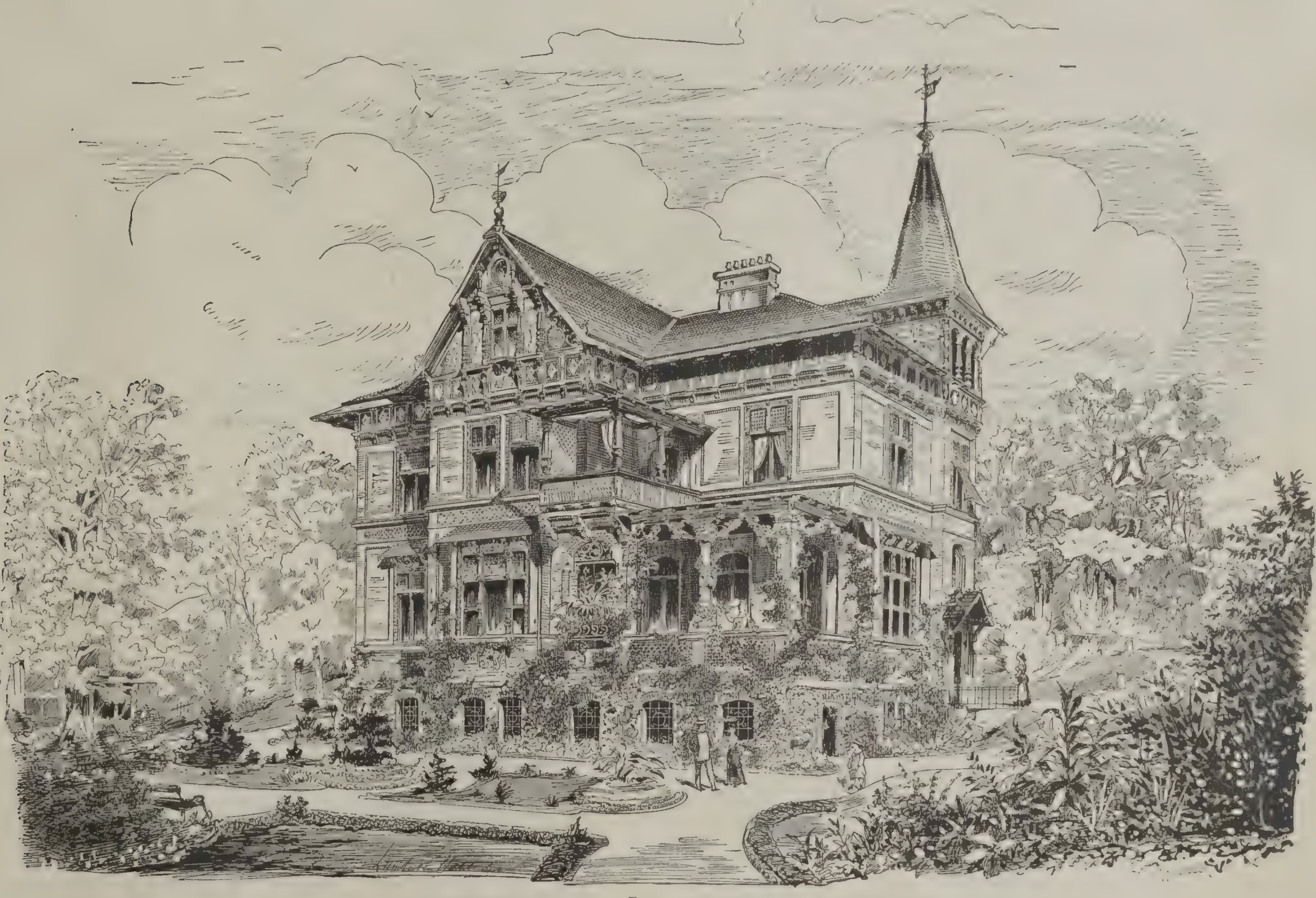
"*Norbury Booths Entrance Lodge.*—This building is in course of erection as a new entrance lodge to Booths Hall, Knutsford, Cheshire, the property of J. P. Legh, Esq. It adjoins the Chelford road, and is placed among the stately timber that skirts the park. Accommodation is given on the ground floor for parlor, living-room, and scullery, with out-offices, and for three good bedrooms over. In design it has been intended that the building should harmonize with the half-timbered examples in which Cheshire so richly abounds."

A VIENNESE VILLA.

Our engraving shows a villa in Dornbach near Vienna, built by A. Von Wielemans, architect, of Vienna.

It is built on sloping ground and is for the use of one family. The basement contains the servants' rooms, storerooms, etc., the first story the parlors, dining rooms, etc., and on the other floors the sleeping rooms are arranged.

The wall of the basement is of rough stonework, the next course of brick, and of the upper story is visible woodwork with sgraffitto fillings. The roof is covered with unglazed tiles, but the ridge, etc., are finished with glazed tiles.—*Architektonische Rundschau.*



A VIENNESE VILLA.—A. v. WIELEMANS, ARCHITECT.

Panama Hats.

Now that the summer season is on us, it may not be uninteresting to the reader to learn something about the origin and manufacture of Panama hats. This is given by Dr. Seeman, in an interesting article on the vegetation of the Isthmus of Panama, in the *Journal of Botany*. An indigenous production, he says, deserving of especial notice, is the "Jipijapa" (*Carludovica palmata*, R. and P.), a palm-like plant, of whose unexpanded leaves the far-famed "Panama hats" are plaited. This species of *Carludovica* is distinguished from all others by being terrestrial, never climbing, and bearing fan-shaped leaves. The leaves are from six to fourteen feet high, and their lamina about four feet across. The spathe appears toward the end of the dry season, in February and March. In the Isthmus the plant is called "Portorico" and also "Jipijapa," but the latter appellation is the more common, and is diffused all along the coast as far as Peru and Chili; while in Ecuador a whole district derives its name from it. The plant is common in Panama and Darien, especially in half shady places, but its geographical range is by no means confined to them. It is found all along the western shores of New Granada and Ecuador; and has been found even at Salango, where, however, it seems to reach its most southern limit, thus extending over twelve degrees of latitude from north to south. The Jipijapa or Panama hats are principally manufactured in Veraquas and Western Panama. Not all, however, known in commerce by that name are plaited in the Isthmus; by far a greater proportion being made in Manta, Monte Christi, and other parts of Ecuador. The hats are worn almost in the whole American continent and the West Indies, and would probably be equally used in Europe did not their high price (varying from $2 to $150) prevent their importation. They are distinguished from all others by consisting only of a single piece, and by their lightness and flexibility. They may be rolled up and put into the pocket without injury. In the rainy season they are apt to get black, but by washing with soap and water, besmearing them with lime juice or any other acid, and exposing them to the sun, their whiteness is easily restored. So little is known about these hats, that it may not be out of place to give an account of their manufacture. The "straw" (paja), previous to plaiting, has to undergo several processes. The leaves are gathered before they unfold, all their ribs and coarser veins removed, and the rest, without being separated from the base of the leaf, is reduced to shreds. After having been exposed to the sun for a day, and tied into a knot, the straw is immersed in boiling water until it becomes white. It is then hung up in a shady place, and subsequently bleached for two or three days. The straw is now ready for use, and in this state sent to different places, especially to Peru, where the Indians manufacture from it those beautiful cigar cases, which sometimes bring as high as $30 each. The plaiting of the hats is very troublesome. It commences at the crown and finishes at the brim. The hats are made on a block, which is placed upon the knees, and requires to be constantly pressed with the breast. According to their quality, more or less time is occupied in their completion; the coarser ones may be finished in two or three days, while the finest may take as many months. The best times for plaiting are the morning hours and the rainy season, when the air is moist. In the middle of the day, and in dry, clear weather, the straw is apt to break, and this, when the hat is finished, is betrayed by knots, and much diminishes the value.

The Indestructibility of Matter.

This is capable of ready demonstration by preparing a couple of glass tubes of equal weight, each being filled with pure oxygen, and containing a few particles of carbon, free from appreciable amount of ash; that prepared from the fine loaf sugar gives very good results. The tubes are of precisely equal weight, and are hermetically sealed. By heating one of them the charcoal is caused to burn, and ultimately to disappear; the tube and contents, however, are of course found still to balance the other tube (which has not been heated), being of precisely the same weight as it was at first.

The Protection of Woodwork.

It not unfrequently happens, when a frame structure is hastily erected—and in our country they are always hastily erected, especially bridges—that a good oil paint is properly applied, and yet in a comparatively short time it begins to peel off more or less completely, making it necessary to repaint them. What is still more unfortunate, some timber, which has had a good coat of oil or tar paint that did not peel off, begins to decay in a short time, so that the original intention of the paint is not fulfilled, but, on the contrary, the paint itself seems to hasten its destruction.

These and similar circumstances lead people to distrust paint as a wood protector, and from different quarters we hear the assertion that unpainted wood will last longer than it would if painted.

This view, says Engineer Sauerwein, requires modification. In judging this matter, we must ask how long was it from the time the wood was felled until it was painted, and was it dry or not, for these unfortunate cases have only occurred in wood which was painted too soon.

It is well known that the sap of wood contains substances like albumen, gelatine, gum, etc., which easily undergo decomposition, and, under certain circumstances, such as favor fermentation, and in warm, damp air are able to destroy very rapidly the stronger woody fibers. The more sap there is in the wood, that is to say, the greener it is, and the sooner the evaporation of this sap is stopped by an air-tight cover, the quicker the fermentation will set in, and with it the destruction of the woody fiber.

These circumstances are correctly understood by practical men, who prescribe that the timber be felled in winter, and try to obtain a free circulation of air through the structure.

They think they avoid the disadvantages above mentioned if they, further, demand "seasoned wood," because it is clear that there is less danger of decomposition in such wood than in fresh or green stuff. But here we at once stumble on this difficulty, namely, of determining what degree of dryness in the wood to be tested seems most advantageous for its use, and the time required for this is much longer than generally supposed. The appearance of the wood is very seldom a reliable guide, and people are accustomed to think that the wood is much drier than it really is. The comparatively important changes which the wood undergoes during the first year from shrinkage enable us to measure approximately the time necessary to destroy the last evil effects of its interior life. Not until it has reached this stage, which requires four to six years, unless artificial seasoning is resorted to, is the timber benefited by covering it with a protecting coat of paint. At this time the paint must have a beneficial effect in protecting the wood, for it prevents atmospheric moisture penetrating into the wood to serve as a reagent to decompose the albumen, which is now dried and coagulated as well as less abundant.

Owing to the position of the lumber yards and the urgency for materials to build with, it is seldom possible to obtain well seasoned lumber and wood. Sauerwein, therefore, proposes the following process: The most rational and sensible process for large, heavy timbers is the impregnation, as for railroad ties, with chloride of zinc under six to eight atmospheres of pressure, where this can be done. (Fresh, green wood is best for this.) No arguments are necessary in defense of the value of this method; it cannot be too strongly recommended, nor is the expense great—about one dollar per cubic meter. When there is no opportunity for impregnation, the woodwork should be left two or four years unpainted.

In my experience, says Sauerwein, wood tar is better than coal tar, because it penetrates into the wood more easily, and, containing a larger amount of antiseptic substances, its effect is more permanent. Although wood tar is considerably dearer, it is to be preferred. Its color being somewhat similar to wood color, it can be used on small, unimportant buildings. Its cost is only one fourth that of oil paint, and can be applied by a common workman.

Planed and worked surfaces should be merely oiled (three times), not painted. Besides having a better appearance, this oil varnish is necessary to prevent cracking and drawing of thin parts—like doors and windows. It does not interfere with the gradual drying out of the wood.

After the expiration of three to five years, the oiling may be replaced by a protecting coat of paint to prevent water from penetrating into the woodwork. It should be added that it seems advantageous to mix bout one part of elutriated chalk with three parts of the white lead which is used with the special color for all oil paints. This seems to make the paint adhere better to the wood, as shown by experience.

Without going into the subject of oil paints, the author cautions the public against the many new fangled and highly extolled paints and substitutes. They are generally much dearer, he says, and at best are only equal to ordinary linseed oil paint made with equal care from well selected pure material. The chief effect of a good oil paint depends on the purity of the materials used, especially of the oil and white lead or zinc white, whether it is finely ground and thoroughly mixed, and the paint carefully applied in good weather.

Curious Intermittent Spring in Guatemala.

M. De Thiersant, Chargé d'Affaires of France in Guatemala, gives in *La Nature* the following account of a phenomenon witnessed by him in the last named country. At about ten miles from the capital, near a town called Nejapa, on the lowest declivities of the volcano of San Salvador, there is a spring known in the country under the name of Rio Huido (fleeting river), which, for a period of seven consecutive years, furnishes enough water to form a true river. The waters of this spring are crystalline and wholesome, and, it is said, are excellent for certain diseases like leprosy, and for strengthening the system when debilitated by the climate. As soon as the seven years are completed, these same waters disappear at a certain definite hour, the spring ceases to flow, and the river bed, becoming completely dried, exhibits thereafter nothing but sand and dust. The intermittent periods have been as follows: From 1866 to 1873 the waters flowed; from 1873 to 1880 the spring ceased; and in the month of January of the present year, the spring began to flow again. This phenomenon is doubtless not a new one, and science has long ago explained it, but there do not perhaps exist many springs the intermittent period of which is so long and so regular as that of the one at Nejapa.

THE CATHEDRAL OF BURGOS, SPAIN.

The Cost of Keeping Soldiers.

The Paris *Constitutionnel* has been calculating the average cost of soldiers in the various European countries. It appears that the annual cost of each soldier in the English army is $700. The soldiers of Austria-Hungary cost $255 each a year. Those of France and Germany, $215 each. The Italian soldier costs a trifle less than $200, and the Russian a little over $190. The maintenance of the army costs annually to each head of the population, 6s. 6d. in Italy, 7s. 4d. in Russia, 8s. 6d. in Germany, 12s. 4d. in France, and 12s. 6d. in Great Britain.

A COUNTRY HOUSE.

In our last issue we gave a number of drawings illustrating the fine residence now in course of erection at Englewood, N. J., from the designs of Mr. Bruce Price, architect, of this city. We now give on page 204 a perspective view of the interior of the spacious and handsome hall, with its elegant mantel and effective arrangement of panelwork. The large size of the hall, beyond its utility as a handsome apartment in itself, gives ready access from and to the garden and all parts of the house. The small sketch of the stair hall will give an idea of the construction of that apartment, which, it will be remembered, is lighted by a large mullioned window, as explained in our last issue.

SOME OLD CATHEDRALS.

The cathedrals of Europe are, many of them, very beautiful, and of great interest from their historical connections and the wealth of objects of art they contain. To the architectural student a careful study of the details of their construction is of value. Many of them were erected in times when but comparatively little attention was paid to the subject of architecture excepting in those buildings erected for the purpose of public worship, which were often designed and carried out on the most lavish system of beauty and costliness.

We give illustrations representing views of five of the old cathedrals of Europe, taken from William Lubke's History of Architecture, published by G. U. Seeman, of Leipzig.

The Cathedral of Notre Dame in Paris is a splendid example of pure Gothic architecture. It was commenced about 1163, the foundation stone being laid by Pope Alexander III. In 1257 the southern transept was completed, in 1312 the northern transept, and the western doors about 1575. The building, which covers the large area of 64,108 square feet of ground, is 390 feet long and 144 feet wide across the transept. The western front, shown in the engraving, is 128 feet wide, and the towers are 224 feet high.

The Cathedral at Mentz, or Mainz is of very imposing appearance, although it has but few claims to architectural merit. The style is Romanesque, and there are many Gothic additions, including the whole of the upper portion of the spire. The erection in its present form dates mainly from the 13th and 14th centuries. The largest of the three fine towers shown in the illustration is 300 feet in height.

Notre Dame at Antwerp is probably the most beautiful Gothic building in the Netherlands. It was commenced between 1352 and 1411, but the west tower and front, shown in the drawing, were not added until the 15th century. The length of the building is 390 feet, and the width is 250 feet.

Bamberg Cathedral is in the Byzantine style, and is one of the finest in the whole of Germany. It was founded by the Emperor Henry II., and finished in 1012, but was partially burned down, and rebuilt in its present form in 1116.

The Cathedral of Burgos, Spain, is in an irregular florid Gothic style, and is remarkable for the beauty of its architecture and its contents of fine monuments. It was commenced in 1221, but was not completed until 1567.

Strength of Wooden Columns.

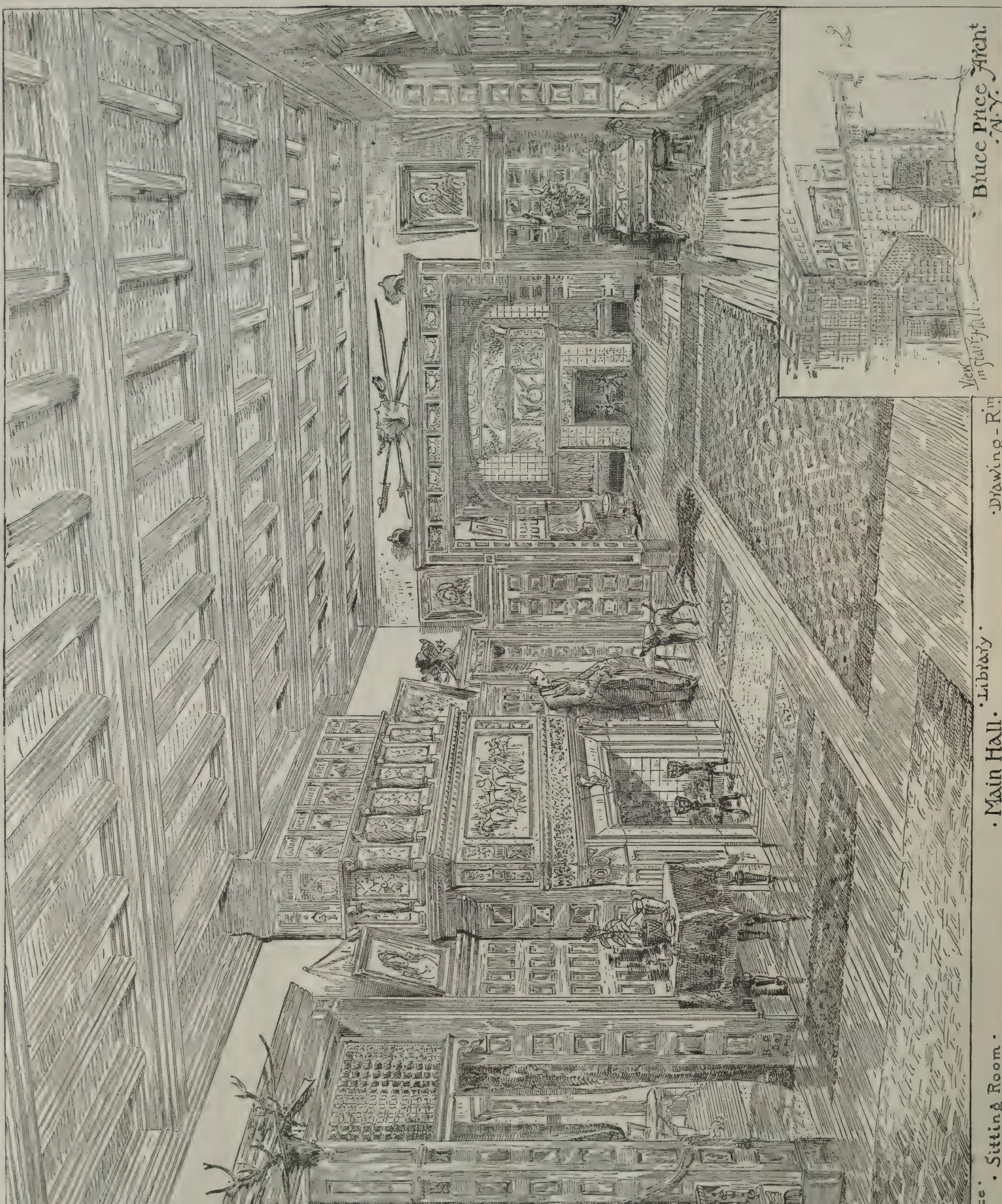
Some important tests of the strength of wooden columns, such as are in common use in the construction of cotton and woolen mills, have lately been made at the instance of Mr. Atkinson, president of the Boston Manufacturers' Mutual Fire Insurance Company. The tests were made with the testing machine at the Watertown arsenal. The formulas in use for computing the strength of wooden columns are based on tests applied to columns of about 2 inches on a side and 4 or 5 feet long. The new tests were made with columns of pine and oak of the size and length used in actual construction. All but two were round, hollow columns, of from 8 to 11 inches diameter, the two being about 9 inches square. The greatest amount of pressure exerted in any case was about 265,000 pounds. The tests have disclosed frequent instances of defective boring in the columns. The object in boring is to open an air passage through the heart of the stick for the prevention of dry rot after it is in position in the building. It is essential, of course, that the bore should extend from end to end, but this has not always been effected. The sticks were bored first from one end and then from the other, and the borings have sometimes failed to meet in the middle of the stick. The tests also show that to taper the sticks is a mistake, inasmuch as it weakens the column more than has heretofore been estimated.

THE CATHEDRAL OF NOTRE DAME, PARIS.

THE CATHEDRAL OF MAINZ.

THE CATHEDRAL OF ANTWERP.

THE CATHEDRAL OF BAMBERG.

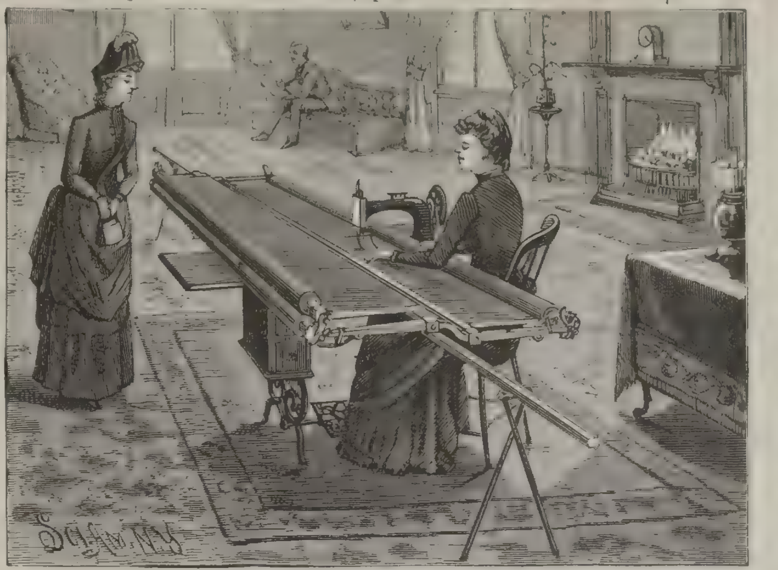


A COUNTRY HOUSE—INTERIOR.—[See page 202.]

DAVIS' QUILTING FRAME.

The engraving shows a new and valuable attachment for all family sewing machines. By its use one lady can make a full size quilt within two hours, a heavy comfortable in one hour, can also quilt children's winter cloaks, bonnets, dress skirts, and coat linings, and do all manner of quilting, from the largest size quilt to the smallest cloak. It is easily understood and operated. The lining of the article to be quilted is rolled up on one of the outside rollers, and the top of the quilt is rolled up on the top outside roller, and when the cotton or wool is to be placed on the lining, the top roller is lifted out of its place and laid back on the machine table, and the cotton placed on the lining, and then the top roller is returned to its place; these operations are repeated until the quilt is finished.

This quilting frame is manufactured by the Davis Quilting Frame Co. Further particulars can be had from the inventor, Mr. Henry T. Davis, 182 and 184 West Houston Street, New York city.



DAVIS' QUILTING FRAME.

Antiquity of Wheat.

President Charles Barnard, in an article in the *Century* for January, says that the wheat plant is one of the oldest in cultivation. The Chinese recorded its culture as early as 2700 B. C., and it is one of the prehistoric plants, remains of wheat seeds being found in the ruins of the houses of the lake dwellers. While there are several races of wheat, and while these have been crossed, producing hybrids, it has retained its true character, and been entirely independent of other plants since its culture began. Compared with wheat, rye is a modern plant. It is not figured on any Egyptian monuments, and seems to have been first cultivated in the Roman empire about the beginning of the Christian era, though it may have been known somewhat earlier in Russia and Tartary. While these two commercial plants have been cultivated side by side for centuries, the first plants appearing to be true hybrids between them bore seeds this year in this country. Wheat and rye may have been crossed before, yet there appears to be no record of anything like the results here obtained.

Art of Making Butter.

Under this title the Patent Office has lately granted a patent to Lyman Guinnip, of Chicago, Ill., for the following:

Take, say, one gallon of cream, keep it in temperature of 60 deg. to 64 deg. for 36 hours, or so that it will clabber; take another gallon of cream, keep in same temperature for 24 hours; put both into a churn, and churn one minute. Then turn out one-third of the mixture and put one pound of butter into this one-third and stir well and let it stand, while you continue churning the two-thirds remaining until seeds of butter appear; then add or put in eight pounds of butter and churn four minutes; then return the one-third which you had previously taken out, and churn the whole until butter is made. If you desire to color the butter, this should be done just before you cease churning.

To make butter from milk only, you follow the same process, and keep the proportions the same. I use no chemicals whatsoever, and make the butter pure and sweet from milk or cream only. The butter put into the churn, if it be of an inferior quality, will come out vastly improved, the rancid part disappearing with the water of the milk.

THE HELICOIDAL OR WIRE STONE SAW.

The sides of solid bodies, whatever be the degree of hardness, and however fine the texture, possess surfaces formed of a succession of projections and depressions. When two bodies are in contact, these projections and indentations fit into one another, and the adherence that results is proportional to the degree of roughness of the surfaces. If, by a more or less energetic mechanical action, we move one of the bodies with respect to the other, we shall produce, according as the action overcomes cohesion, more or less disintegration of the bodies. The resulting wear in each of them will evidently be inversely proportional to its hardness and the nature of its surface; and it will vary, besides, with the pressure exerted between the surfaces and the velocity of the mechanical action. We may say, then, that the wear resulting from rubbing two bodies against each other is a function of their degree of hardness, of the extent and state of their surface, of the pressure, of the velocity, and of the time.

According as these factors are varied in a sense favorable or unfavorable to their proper action, we obtain variations in the final erosion. Thus, in rubbing together two bodies of different hardness and nature of surface, we obtain a wear inversely proportional to the hardness and state of polish of their surfaces. Through the interposition of a pulverized hard body we can still further accelerate such wear, as a consequence of the rapid renewal of the disintegrating element.

The gradual wear effected over the entire surface of a body brings about a polish, while that effected along a line or at some one point determines a cleavage or an aperture.

The process usually employed in quarries or stoneyards for sawing consists in slowly moving a stone saw backward and forward, either by hand or machinery, and with scarcely any pressure. Mr. P. Gay, of Paris, has, however, devised a new process, which is based upon the theoretical considerations given above. His *helicoidal saw* is, in reality, an endless cable formed by twisting together three steel wires in such a way as to give the spirals quite an elongated pitch.

APPLICATION OF GAY'S STONE SAW IN A MARBLE QUARRY.

The apparatus in its form for cutting blocks of stone into large slabs consists of two frames, placed several feet apart, each formed of two iron columns, 7½ feet in height, fixed to cast iron bases. The upper part of the frame supports a transmission composed of gear wheels and a pitch chain. Along the columns of the frame, which serve as guides, move pulley carriers. The pulleys are channeled, and receive the cable, which serves as a helicoidal saw. The carriages are traversed by screws, which are fixed between the columns. The extremity of the axle of the pulley to the right is threaded, and actuates a helicoidal wheel, which transmits motion to the wheel. The transmission, completed by the wheels and the pitch chains, is designed to move the saw vertically, through the simultaneous shifting of the carriages. A tension weight, through the intermedium of pulleys, permits of keeping the saw taut. A reservoir, at the upper part of the frame, contains the water and sand necessary for sawing. The feeding is effected by means of a rubber tube, terminating in a flattened rose, which is situated over the aperture made by the saw. A small pump, over the reservoir, raises water. The sand is put in by hand.

A system of rails and ties supports the carriage, upon which is placed the block of stone to be sawn. When one operation has been finished, and it is desired to begin another, it is necessary to raise the pulley carriers and the saw. In order to do this quickly, there is provided a special transmission, which is actuated by hand through a winch.

The work done by this saw is effected more rapidly than by the ordinary processes, and certain very hard rocks, usually regarded as almost intractable, can be sawed at the rate of from one to one and a half inches per hour.

For sawing marble into slabs of all thicknesses, the arrangement described above may be replaced by a system consisting of two drums having several channels to receive as many saws, or two corresponding series of channeled pulleys, independent of each other, but keyed to the same axles. When the pulleys have been properly spaced by means of keys, the whole affair is rendered solid by a bolt. The extremity of the axles forms a nut into which pass vertical screws. These latter are connected above with cone wheels which, gearing with bevel wheels keyed to the shafts, secure a complete interdependence of the whole. The ascending motion, which is controlled by endless screws and the helicoidal wheels, is in this way effected with great regularity.

The power necessary to run this kind of saw is less than $n \times \frac{1}{4}$ H. P., on account of the number of passive parts. The most interesting application of the helicoidal saw is in the exploitation of quarries. Our engraving represents a Belgian marble quarry which is being worked by Mr. Gay's method.

Tubular Perforators.—Mr. Gay has rendered his saw completer by the invention of a tubular perforator for drilling the preliminary well. It is based upon the same principle as the Leschot rotary drill, but differs from that in its extremity being simply of tempered steel instead of being set with black diamonds. A special product, called metallic agglomerate, is used instead of sand for hastening the work.

The apparatus consists of an iron plate cylinder, 27½ inches in diameter, and of variable length, according to the depth to be obtained, and terminating beneath in a steel head of greater thickness. This cylinder is traversed by a shaft, to which it is keyed, and which passes through the center of the aperture drilled. This shaft is connected with the cylinder through the intermedium of cross bars, and transmits thereto a rapid rotary motion, which is received at the upper part from a telodynamic wire that passes through the channel of the horizontal pulley. This latter is supported by a frame consisting of three uprights strengthened by stays, fixed to the ground.

In order that the cylinder may be given a vertical motion, cords fixed to a piece loose on the hub wind round the drum of a windlass, after passing over the pulleys.

The rapid gyratory motion of the cylinder, along with the erosive action of the metallic agglomerate, rapidly wears away the rock, and causes the descent of the perforator. During this operation a core of marble forms in the cylinder. This is detached by lateral pressure, and is capable of being utilized. The tool descends at the rate of from 20 to 24 inches per hour, or from 8 to 10 yards per day in ordinary lime rock.

Our engravings, for which and the above particulars we are indebted to *Le Genie Civil*, show the application of the system of quarry working where all of the various saws and drills are operated by a single engine, with which they are connected by wires as represented.

Hallucination of the Senses.

Professor Maudsley remarks, in a recent lecture, that one striking feature observed by medical men who have had cases of hallucination under their charge is that the patients cannot be convinced that the objects they see, the sounds they hear, and the smells they perceive have no real existence, and that the sensations they receive are the result of their excited nerves. It frequently happens, too, that a person who suffers from hallucination in respect of one sense has the others unaffected, and is, on all other matters, perfectly normal. Hallucination may arise either from an idea on which the mind has dwelt appearing as something exterior, or from excitement of the sensory ganglia. It is said that Newton, Hunter, and some others of equal professional eminence could, at will, picture forms to themselves till they appeared to be realities.

ORNAMENTAL ENTRANCE GATES.

A pair of wrought iron entrance gates of the pleasing design illustrated in the engraving form part of a Berlin restaurant. The gas lamp holder was designed to accord with them, and is very effective in filling up the void at the top of the door underneath the arch, and in producing a graceful and attractive outline. The gates and gasholder were manufactured by Dregerhoff & Schmidt from the designs of U. Wegener.

ORNAMENTAL ENTRANCE GATES.

Waterproof Writing Ink and Paper.

An incident connected with the loss of the steamer Oregon and her cargo calls attention to some much needed inventions.

A portion of her mail was saved before she sank, but the bulk went down with the ship. A considerable portion of this mail is reported to be of great value, containing securities, coupons, etc., amounting, as has been estimated, to over half a million of dollars, besides drafts, letters of credit, etc., the value of which is unknown.

A wrecking company employed to inspect the wreck, and report upon the possibility of recovering the ship and the cargo, reported that the cargo and mail might probably be got out of the steamer, and the reconnoitering steamer also picked up some floating mail bags and brought them to New York, where their contents were dried previous to forwarding them to their ultimate destination. Much of this mail matter was, of course, badly damaged by wetting, and more serious injury is to be expected in that which, at the bottom of the sea, must be subjected to long soaking prior to its recovery, if ever recovered.

Now, to secure a mail, as far as possible, from injury by submergence in salt or fresh bodies of water, there must be waterproof mail bags, waterproof paper, and waterproof ink.

Waterproof mail bags will not alone be sufficient, as in the process of handling or raising them from a wrecked vessel they are liable to be rendered leaky, and waterproof paper would be of no service unless it was accompanied by waterproof ink.

The mail bags need only be waterproof in the common acceptation of the term, and, if there could be certainty that they would remain so, nothing more would be needed to protect documents or anything else permitted in mail bags; but as holes are likely to be worn or torn in them, the only final resource is in the production of paper and ink that will resist the prolonged action of sea water.

There can be no doubt, we think, that if paper and ink which will meet this requirement can be furnished at reasonable cost, they would at once find a ready market throughout the civilized world, provided certain other requirements are at the same time complied with.

Waterproof paper and waterproof ink already exist. What is known as parchment paper will withstand the action of sea water indefinitely, and this can, of course, be written upon by certain carbon inks in market containing materials that, once dried, are thereafter practically insoluble. But that these do not meet the wants of the public for writing materials is proved by the fact that they are not universally employed for transatlantic correspondence. The materials required must not only resist the action of sea water, that is to say, the sodium chloride, iodine, and bromine held in solution, but they must be nearly or quite as convenient to use as ordinary paper and ink.

The paper should be light, flexible, and opaque, to economize postage; fold easily, and prevent writing from showing through. As for economy in foreign mails, it is essential that paper should permit writing upon and copying from both sides.

The problem is both mechanical and chemical in its nature, and the resources of modern chemistry and mechanics should be, we have no doubt are, equal to its solution. Any seeming incompatibility in the requirements named will probably vanish in a careful study of these resources.

The Egyptian Sphinx.

An appeal has been made by M. Ernest Renan for funds to enable M. Maspero to remove the sand from around the Great Sphinx. The work, he says, is valuable, and will enable us to descend into a world that is more than 6,000 years old, and will push farther back the limits of a past age that seems to become more remote as we try to reach it.

"The clearing of the Great Sphinx," says M. Renan, "was begun two months ago. Up to the present time the ordinary resources of the Boulak Museum have sufficed for the work, which might be completed in sixty days if money did not fail. About 20,000 francs only are wanted. The appeal for the Longson excavations, which was addressed two years ago to the intellectual public, was so fruitful that we are encouraged once more to ask the true connoisseurs in ancient things to contribute to one of the works, the most imperiously demanded by the present condition of Egyptology. The Great Sphinx of Ghizeh, at two steps from the Pyramids, is, in my opinion, the most astonishing work of the hand of man which past ages have bequeathed to us. It is an immense bed of carved rock, about 70 meters in length. The height of the monstrous edifice, if it were cleared, would exceed that of the highest houses. No fashioned monument, either in the rest of Egypt or in the rest of the world, can be compared to this strange idol, the vestige of a stage of humanity which baffles all our ideas. The impression which such a spectacle must have produced on imaginative races, and who were dominated by the senses, may be understood from that experienced by the Egyptians of the present day when standing before that enormous head emerging from the sand and casting across the desert its sad look. The Arab at this sight flies terrified, either throwing a stone or firing a gun at the strange being. The temple opposite the Sphinx, if it is a temple, has also a character of its own. This fantastic construction resembles less the other temples of Egypt than the Pantheon resembles Notre Dame. But that all this ensemble, which is unique in the world, must be of the remotest antiquity is indisputable, since the statues found there are those of King Chepren, thus taking us back to ages which everywhere but in Egypt would be called fabulous."

MILK weighs so very little more than water that it requires a careful measurement to judge it by weighing a quart. It seldom weighs as much as 0·035 more than water.

FRENCH EXHIBITS OF TRAINED FRUIT TREES.

How many of the readers of the SCIENTIFIC AMERICAN have fruit trees? Of this number how many take an interest in their progress and development, and how large—or small—a proportion of these get as much pleasure out of the possession as it is capable of yielding?

We do not value what does not cost us care. We need a pursuit or hobby of some kind outside of our daily business, and we cannot all afford a yacht, a pair of horses, or frequent excursions. The importance of a pursuit to a man is not measured by its expensiveness, nor does his interest in a collection depend upon its intrinsic value. One person will take more pleasure in a collection of *unios* from the waters of the Mississippi Valley than another in the gold and silver coins of the Roman emperors. The possessor of a $50,000 gallery of paintings can possess, at that figure, but few notable pictures, but less than a hundredth part of the sum will perhaps buy, wall, and plant a garden which can be a thing of beauty and a joy forever—in its season.

To enjoy a garden thoroughly, a person must be his or her own gardener. If he be a person of business, it is best not to be too ambitious as to size of garden. One carefully kept offers as much pleasure to the square rod as nature can afford, and even the mental culture of the study and library, though not in any sense to be depreciated, does not yield a more wholesome enjoyment, perhaps is itself apt to become lop-sided, like a badly pruned and ill-balanced tree.

The taste for gardening is on the increase in America, but there is much progress yet to be made before the outskirts of our towns and cities and the homesteads of our farmers will look civilized or comfortable. The taste for flowers and the love of neatness evinced in France appear remarkable to a person familiar with the approaches to American towns and to the appearance of the mining village or average farmhouse. No one looking at the forlorn rows of houses in the mining regions of Pennsylvania, for instance, without privacy, garden, paint, shade, or any sign of living better than a dog, need wonder at Molly Maguires and other brutalities.

Inasmuch as the dwellers in towns and villages have the greatest need for gardens, as the fields are remote, the plan of culture which will make a small plat the most interesting is the one to be desired. For this purpose the use of the *espalier* system of Europe is thoroughly adapted. It is partly the growth of the economical and neat habits of the people, and partly arises from the fact that the peach, nectarine, and apricot require the warmth of the sunny side of a wall to ripen the fruit in this latitude, which is considerably north of Quebec, though not subject to the same extremes, either of heat or cold, as that city of the rock.

Unsightly walls and fences, valuable as screens for safety and privacy, become aids both to the appearance and productiveness of the plat of ground. Great ingenuity and taste are displayed by the French in their modes of training so as to cover with an even coat of verdure the sides of their walls. The illustrations given are from the trees planted in the Exhibition grounds, and exhibit a great many different styles and combinations. The trees are apple, pear, peach, nectarine, apricot, plum, and cherry. The quince has a slow and crooked growth, and does not take kindly to the flat culture. Some pear trees now cover the sides of houses in England and France; one I noticed occupied about 1,200 square feet of surface at the end of a large brick house, and was perhaps 10 inches through the trunk near the ground. We are all familiar with the treatment of vines in this manner, but are not so much so with nailing tomatoes to the wall, as I saw in the South of Ireland, and with training a currant into a fan-shaped bush, six feet high and as many broad, as I noticed in Wales.

In the illustrations, it may be remarked, there is not a single abnormal shape—not one that cannot be found in trees growing naturally or in orchards. Bends, crooks, turns, and winds are all common enough in all kinds of trees, but for the purposes of neatness and adaptation to limited area and height, the trees are made to take their bends according to regular patterns, favorable shoots being selected, some trees by the accidents of growth, while small, offering much better specimens for certain kinds of training than for others.

The illustrations do not require explanation, an ounce of drawing being worth more than a pound of description. They were all made in the garden which surrounds the building in the *Champ de Mars*, and were sketched on the spot; the most ornate is one nailed against a brick and stucco house on the French side of the grounds. It consists of five peach trees and two low trained apples. The centra part is ten feet high, and it looked for a while as if the trees would not live, but they are now all out in leaf, though the buds will not stay on this season, and next year it will have to make another trip, doubtless. It excites a great deal of attention even here, where *espalier* is the order of the day—groups standing admiring the symmetry, and especially the ingrowth at the base of the shield, where three trees were caused to grow together in the manner of inarching, the trunk of the middle one, below the shield, being afterward cut away. The middle one of the three divaricates above, and each limb, by four sharp angles, is made to form one side of the five-pointed star. Each side tree furnishes two outer bars of the shield-shaped ornament.

The drawings show only the flat modes of training, known as *espalier*, but a score of as curious kinds of standard growths may be considered hereafter. One

TRAINED FRUIT TREES.

word—as we say—on the subject of taking all this amount of trouble. It is not merely a matter of fruit. I will admit, for the sake of the argument, that the same amount of time and pains spent at the bench will bring money enough to buy twice as much fruit as the plat of garden will yield. Suppose it will Does that watch you wear go any better because it is in a gold case? Does the gun shoot any better because the metal of the stock is nickel plated? Does the engine run any better because the bright work is kept polished? Do your clothes fit any better because they are brushed? Is everything to be estimated by its value in cash, and every grace and beauty lopped off our daily lives which has not a direct bearing upon the balance at the banker's?

The question, however, is not so bare a one as this. Perfect efficiency is inconsistent with slovenliness. We must cultivate habits of economy and neatness. There is not an audience in the world which will take a suggestion in better part than the circle of readers of the Scientific American. Men who know how to keep good tools in order, and to use them deftly, cannot be oblivious of the value of system, of training, of care. Men who have carefully and laboriously learned to do work in good time and of good quality will respond at once to the suggestion that the appearance of a well-kept garden will instill into the minds of children a sense of order which will have its effect on their whole future lives. This consideration is even more important than the one previously stated, that of giving a wholesome occupation to the gardener—the proprietor.

Whatever modern science may do to disturb the child-like acceptance of the literal statements of "The Book," we find in it texts for sermons which may do us good. Take two:

One shall be mere citation and a single comment: God made man and put him in a garden—and he did very well as long as he had sense enough to stay there.

"Consider the lilies of the field—how they grow."

If the Master were preaching in Normandy, He would doubtless draw His morals as much from the *espalier* as from the vine. What lessons of the effect of early habit and training would it not evolve! What of productiveness, of the different exposures, of the lavish pruning, or the slovenly neglect! Man works with God on his side; the apricots, pears, and peaches we see on the *espalier* are not wild; man's care for a score of centuries has encouraged the fruit in the line of its adaptability; by careful selection and improvement of its environment, he has evolved a fruit so different from the original that scientific comparison alone establishes the relationship.

An admirer of the *Fragaria* says, "God could doubtless have made a better berry than the strawberry, but He did not." This is mere encomium with an incisive accompaniment which strikes us like an epigram; the moral, however, was missed, perhaps because not looked for. Man made the strawberry in the same sense that he made the field of wheat, derived from wild originals Diodorus Siculus says: "Osiris taught the way and manner of tillage and good management of the fruits of the earth. Isis found out the way of cultivating wheat and barley, which before grew here and there in the fields, among the common herbs and grass, and the use of them was unknown." It was a common custom of old to deify the people's benefactors, and we yet raise statues to such men as Harvey, Watt, Rumford, and Fulton.

"The world is too much with us," in the sense of the factory, the store, and even the library. We need to take things more at first-hand and to encourage the unartificial sense, the capacity to find—

"Books in the running brooks,
Sermons in stones, and good in everything."

E. H. Knight.

Formulas for Fertilizers.

Hon. Levi Stockbridge, Professor of Agriculture of the Massachusetts Agricultural College, Amherst, publishes the following formulas, by means of which the farmer may compound his own fertilizers, and thus save to himself large amounts now paid to those who make a business of preparing these phosphates:

To produce 50 bushels of corn *more* than the natural product to the acre, use:

Nitrogen, 64 pounds, in the form of sulphate of ammonia.

Potash, 77 pounds, in the form of muriate of potash.

Phosphoric acid, 31 pounds, in the form of muriate of superphosphates.

To grow one ton of hay to the acre *more* than the natural product, use:

Nitrogen, 36 pounds, in the form of sulphate of ammonia.

Potash, 31 pounds, in the form of muriate of potash.

Phosphoric acid, 12 pounds, in the form of superphosphate.

To produce 100 bushels of potatoes per acre and their usual proportion of tops *more* than the natural proportion of the land, and other quantities proportionally, use:

Nitrogen, 21 pounds, in the form of sulphate of ammonia.

Potash, 34 pounds, in the form of sulphate of potash.

Phosphoric acid, 11 pounds, in the form of superphosphate.

To produce 25 bushels of oats and the usual proportion of straw per acre *more* than the natural product of the soil, and in proportion for other quantities, use:

Nitrogen, 10 pounds, in the form of sulphate of ammonia.

Potash, 31 pounds, in the form of muriate of potash.

Phosphoric acid, 8 pounds, in the form of superphosphate.

To produce 1,500 pounds of dried leaf tobacco with the usual proportion of stalk *more* than the natural yield per acre of land, use:

Nitrogen, 149 pounds, in the form of sulphate of ammonia.

Potash, 172 pounds, in the form of sulphate of potash.

Phosphoric acid, 16 pounds, in the form of superphosphate.

DESIGN FOR A PORTAL, CORNER FRONT.—BY H. GRISEBACH, ARCHITECT, BERLIN.

Lime, 160 pounds, in the form of sulphate of lime (lime plaster).

These mixtures should be sown over the land broadcast when the ground is well prepared, before planting, and not put in the hills, so that the roots may seek the food and not concentrate and thereby cause the plants to "burn up."

Potash in Agriculture.

It is especially advisable to apply the potash compounds, not alone, but mixed with phosphates and nitrogenous fertilizers. In this way the best practical results have been obtained. Peruvian guano, ammoniated superphosphates, bone and fish, furnish nitrogen, phosphoric acid, and lime, and, if superphosphated, sulphuric acid also. The potash salts supply potash with more or less sulphuric acid and magnesia. Such mixtures therefore would form "complete fertilizers."

The following are the most important practical conclusions concerning the use of the German potash salts as fertilizers:

1. Potassium, the basis of potash compounds, is indispensable to the growth of all our cultivated plants. It has, at least, one specific office in the nutrition of the plant, that of aiding in the formation of carbohydrates (starch). Without a plentiful supply of potash in available forms, full crops are impossible.

2. The German potash salts afford at present the cheapest and most available supply of potash for fertilizers. They supply also more or less magnesia and sulphuric acid, which are essential ingredients of plant-food, and sometimes deficient in our soils, and sodium and chloride compounds, which latter may be beneficial or harmful, according to the circumstances of their use.

3. The higher grades will be most profitable for use in this country, because they furnish the most potassium with the least admixture of inferior materials, on which costs of freight and handling must be paid. The chloride (muriates), with 60 to 84 per cent. of chloride of potassium, and the sulphates, with 70 to 80 per cent. of sulphate of potash, or the sulphate of potash and magnesia, with 54 to 57 per cent. of sulphate of potash, are to be especially recommended.

4. For potatoes, sugar beets, or tobacco, the sulphates are preferable; for other crops, the chlorides, which are cheaper, are equally good.

5. In order to secure uniform diffusion through the soil, the potash salts should be applied as long as possible before the crop is sown. It is well to mix with earth, or to compost, before applying, especially if used shortly before sowing the seed. And, in general, potash salts are well adapted for composting with muck, earth stable manure, phosphates, fish, and the like.

6. The best results are generally obtained by using potash salts, not alone, but with other fertilizers, as superphosphates, guanos, and fish. Mixtures of these latter with potash salt form "complete fertilizers." The proper use of potash salts is as adjuncts to other fertilizers.

7. From 200 lb. to 400 or 500 lb. per acre of higher and 300 to 600 lb. of the lower grades are appropriate quantities.

8. The question of the need of potash in a given soil can be best decided by actual trial. It will be generally advisable to test the question by experiments on a small scale, before making large purchases.—*Prof. W. O. Atwater, in Report of Connecticut Board of Agriculture.*

What a Spider Eats per Diem.

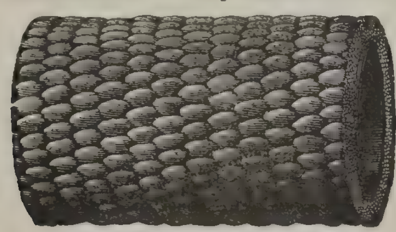
In order to test what a spider can do in the way of eating, we arose about daybreak in the morning to supply his fine web with a fly. At first, however, the spider did not come from its retreat, so we peeped among the leaves, and there discovered an earwig had been caught, and was now being feasted on. The spider left the earwig, rolled up the fly, and at once returned to his "first course." This was at half past 5 A. M. in September. At 7 A. M. the earwig had been demolished, and the spider, after resting a while and probably enjoying a nap, came down for the fly, which he had finished at 9 A. M. A little after 9 we supplied him with a daddy-long-legs, which he ate by noon. At 1 o'clock a blow-fly was greedily seized, and then immediately, with an appetite apparently no worse for his previous indulgence, he commenced on the blow-fly. During the day and toward evening a great many small green flies, or what are popularly termed midges, had been caught in the web; of these we counted one hundred and twenty, all dead and fast prisoners in the spider's nest. Soon after dark, provided with a lantern, we went to examine whether the spider was suffering from indigestion, or in any other way, from his previous meals; instead, however, of being thus affected, he was employed in rolling up together the various little green midges, when he took them to his retreat and tea. This process he repeated, carrying up the lots in little detachments, until the web was eaten, for the web and its contents were bundled up together. Taking the relative size of the spider and of the creatures it ate, and applying this to man, it would be somewhat as follows: At daybreak, a small alligator was eaten; at 7 A. M., a lamb; at 9 A. M., a young camelopard; at 10 o'clock, a sheep; and during the night, 120 larks.—*New Era.*

WOVEN COTTON HOSE.

Although the manufacture of cotton hose was only undertaken for the first time about fifteen years ago, it has already come into very general use, and appears in the markets as a brisk and successful competitor with rubber hose. Among the first firms to engage in the fabrication of a seamless, rubber-lined hose was the Boston Woven Hose Co. Their early efforts in this

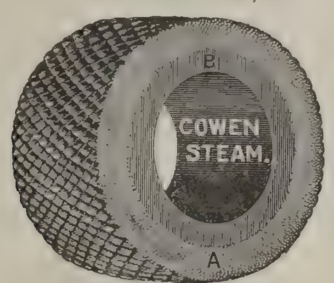
STEAM PACKING.

direction were in the manufacture of a fire hose of three plies of cotton, held together by the threads and lined with rubber. Though an improvement in some respects over the ordinary rubber hose, this proved rather stiff and bulky, and not altogether satisfactory to the manufacturers. They therefore made the ex-



COTTON GARDEN HOSE.

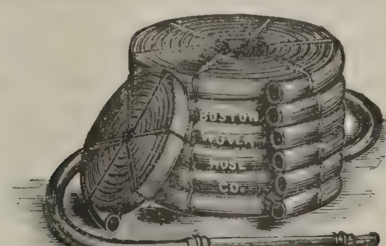
periment of forming their hose out of stronger yarn, and instead of having three connected plies, made it of two plies, not connected. This change greatly increased the pliability of the hose without in any way lessening its strength They have since made other improvements in their fire hose, until the present



COWEN STEAM HOSE.

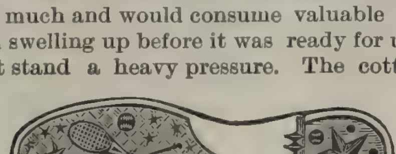
product, designated as the "Boston Fire Jacket," will withstand a pressure of a thousand pounds to the square inch.

After perfecting the fire hose, the company turned their attention to the manufacture of mill hose, which was much needed at the time. For this use rubber has



RUBBER HOSE.

certain disadvantages. Besides being more bulky, it is apt to become dry, and crack, when left for any length of time. Under the same circumstances, linen would leak too much and would consume valuable time and water in swelling up before it was ready for use Nor would it stand a heavy pressure. The cotton hose,



MOULDED TENNIS SOLE.

however, has several qualities which make it particularly suitable. It can be packed away in small bulk, and besides being exceedingly strong, will not dry up, as the rubber in this case is made of the best quality, and is protected by the cotton cover. It has now been introduced into many large mills, and has proved very satisfactory.

It is made in all sizes, to fit different stand pipes The company have recently added the manufacture of garden hose to their other specialties. They started out with the determination to make a cotton garden hose that would stand the wear and tear better than those now in use, and so far succeeded that its sales amounted to a million feet in a year. This hose is made on the principle that a string wound spirally around an ordinary hose adds greatly to its strength. The company believe that the superiority of this article is due to the fact that rubber hose is apt to decay, as the cotton duck on which its strength largely depends, draws in water at the exposed ends of the section, and at any injured place in the outer covering, until the entire length is saturated. The coats of rubber prevent the drying of the duck, and the confined moisture and sulphur in the rubber together prove so destructive to the fiber that it soon decays, rendering the hose comparatively worthless, in spite of the purity of the rubber employed. The cotton garden hose, however, may be soaked every time it is used; but, having no outside cover to imprison the moisture, will soon dry and leave the cotton uninjured.

The success of these different cotton hose encouraged experiments with steam hose. After a year's work at the problem, and the trial of numerous expedients, the present process was suggested, and having given excellent results, the product was manufactured on the large scale, and called, in honor of its inventor, the "Cowen" steam hose. It takes the place of a 7-ply marline wound, extra heavy, steam hose, and costs 20 per cent less. It depends for its resistance to bursting pressure upon cotton jackets which are woven with heavy filling threads running spirally the whole length of the hose. The strength of rubber hose depends, in great measure, upon the sticking power of the rubber between the different layers of duck. After steam has been run through it a short time, the rubber is apt to soften and give way. When this occurs, the hose swells or blisters and soon bursts. The Cowen hose is free from this danger. It has a lining which is cured just enough to stick to the fabric strongly, and in time and with use becomes thoroughly cured by the passing steam. It has consequently a longer life than the ordinary steam hose. By the time it gets cured to the point where the rubber hose is at starting, it has already outlasted it and is good for a second term. Such a result is not possible with an ordinary rubber hose, since it is necessary for the strength of the article that the rubber should be thoroughly cured in the beginning. The Cowen hose gave very good results under severe tests. It has now a record of over six months' use on a dredging machine, under 90 pounds steam pressure, and of several months' use on rock drills.

It early became apparent in the experience of the firm that they would be obliged to make their own rubber tubes, in order to get good ones, so they have introduced into their factory, from time to time, rubber machinery of approved patterns, until they have now a thoroughly equipped rubber plant in addition to that for cotton hose Both departments enjoy equal success. The Puritan rubber fire hose is made of the same duck as is used in the sails of the victorious yacht of that name, and of the best Para rubber. In pliability and strength, it is equal to any rubber hose in the market. Another of their specialties is rubber tennis soles. They have several designs, and were the first to make a moulded sole with cloth insertion to sew on tennis shoes.

The factory of the company is at Cambridgeport, and their principal office at 234 Devonshire Street, Boston The officers are: Theo. A. Dodge, President; J. Edwin Davis, Treasurer; and Robert Cowen, Superintendent.

THE STEAM CHIME.

The absence of some means of atrracting the attention of deaf mutes independently of the eye has always been a very inconvenient fact attending their condition, and has been a great annoyance to persons having charge of numbers of them, especially in institutions for their education. Perhaps nothing has given superintendents more anxiety than the extreme difficulty there would be of arousing them from sleep in case of fire in the night, since every one of them must be personally touched. Dr. Gillett thinks he has overcome this difficulty, and it really looks as if he has, besides having a means of giving the pupils signals to assemble and disperse for various purposes, as a bell does hearing and speaking people.

The Crosby Steam Gauge and Valve Company have lately been manufacturing an instrument which they call "The Patent Single Bell Chime Steam Whistle." Some of these are of immense size, and make powerful musical tone, which is not only far-reaching as a sound, but produces a vibration of the solid ground and of buildings near at hand. Conceiving that these might be utilized in an institution for the deaf, Dr. Gillett procured one of the largest, four feet long by twelve inches in diameter, and having placed it on the pinnacle of the tower of the boiler house, has been testing it for a fortnight. His expectations have been more than realized. A large majority of the pupils are conscious of its signals when given, and if more favorably located, which will be done hereafter, all of them would be.

Since beginning its use it has not been necessary in the morning to arouse any of the boys by any other means, and so many of the girls are awakened by it that they immediately "call up" the others. As the fires under the boilers never go out, and the steam never goes down, and as there is always an engineer on duty day and night, from one year's end to another, the value of this steam chime in case of fire is incalculable. The pupils could all be awakened in one minute, and many lives that would, without this, be in extreme danger are as safe as the lives of persons who hear.

This "steam chime" is as pleasant and musical as a pipe organ, being tuned so as to produce simultaneously three distinct tones pitched to the first, third, and fifth of the common musical scale, which harmonize and give an agreeable musical chord, and does not offend the most sensitive musical ear, even when close at hand. Every institution for the deaf which uses a steam heating apparatus should have one of these chimes, and we predict that before long many will have them. None can afford to be without one if the present indications are realized.

Dr. Gillett has an arrangement by which he gets the weather reports from the signal service department, and at twelve o'clock each day the probabilities for the next twenty-four hours are sounded on this steam chime—one long sound indicating fair weather; one

THE STEAM CHIME.

medium long and three short sounds, cold weather; six short sounds, rainy weather; six short sounds in pairs indicating snowy weather. These signals are watched for by many people for miles around, and are appreciated by all.

Wind Pressure.

Does the wind, in passing through the open spaces left between the solid members of an articulated structure (such as a bridge), experience no further resistance than that offered by the net area of the solid surfaces of the members? We think it does. Air is a fluid equally with water, and it is well known that when water issues through an orifice in a flat surface, the issuing stream is very sensibly contracted to much less than the area of the orifice. This coefficient of discharge through holes in plates or flat surfaces is as low as 0·62; or, in other words, only 62 per cent of the opening is truly effective for the passage of the liquid. Without doubt, these principles apply equally to all fluids, gases as well as liquids. In the case, then, of air flowing through an articulated structure, we do not think that the full area of the openings between the solid members should be considered as effective for the passage of the air, but only to a reduced extent of, perhaps, from 60 per cent to 70 per cent. This would have the effect of adding very largely to the gross resistance offered by any articulated structure to the wind—in fact, it would cause an addition of from 30 per cent to 40 per cent of the openings to be added to the solid members as representing the whole area offering a resistance to the passage of the wind. This additional amount of resistance may be found more than sufficient to occasion overturn, when otherwise it would be far from being anticipated by calculation. —*Iron*

THE WATERHOUSE ELECTRIC LIGHT.

In the grand rush of putting in electric lights, some three or four years since, the arc light was condemned for isolated factory lighting, owing to its unsteady flicker and unreliability.

Dark shadows were a great objection, and impressions against the arc light are yet lasting in the minds of many manufacturers.

Happily these impressions to-day are without foundation, because of the rapid development of electric arc lighting, tending toward perfection, which is the desideratum to be attained.

The steps of advance have been accomplished by diligent, expensive experiments, and the invention of a new system, or of a satisfactory arc light even, has balked and been the impossibility with some large electrical manufacturers, many having started, but come out wanting in some essential particulars.

We illustrate on this page a new system, known as the Waterhouse system, which has been captured by some of the leading manufacturers and business men of Hartford, Conn., who have organized a company, the Waterhouse Electric & Mfg. Co., of Hartford, Conn., with the factory at Colt's West Armory, and are now manufacturing the plants.

The system is new throughout in its important features, and the most important of all is the fact, which is positively claimed, that the system can be operated at a saving of power of 25%, and in some cases 50%, over the other systems now in use. This is certainly important to manufacturers, and the company particularly invite comparison and investigation.

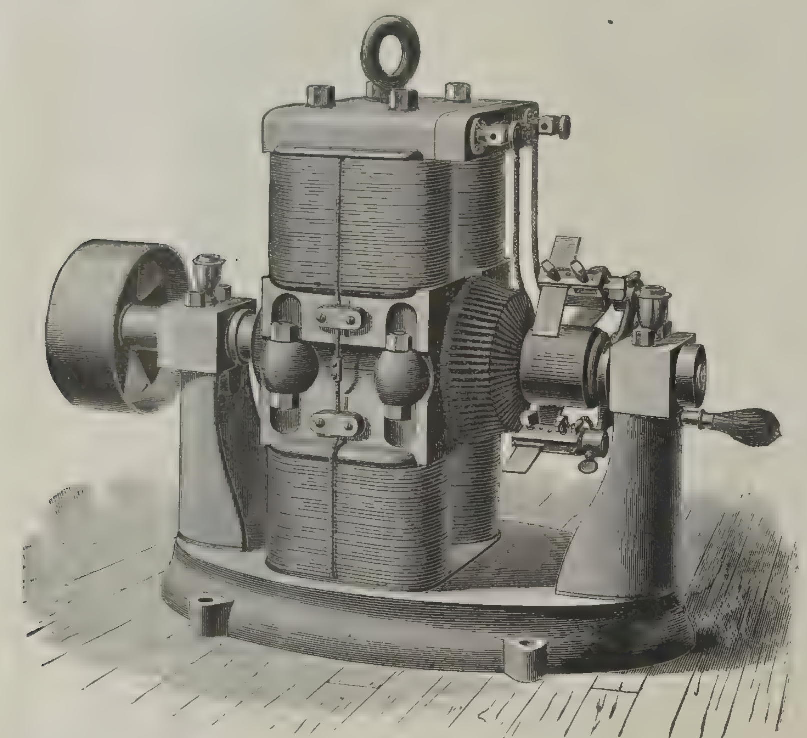


Fig. 1.

Fig. 2.

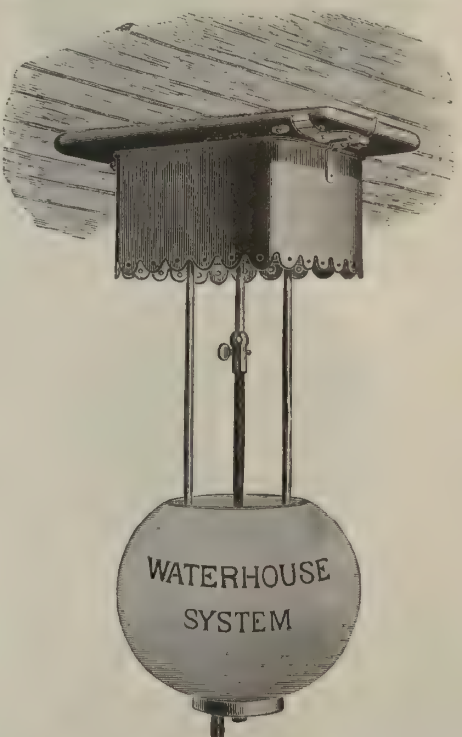


Fig. 3.

THE WATERHOUSE ELECTRIC LIGHT.

Any of the great systems, including this system, can be operated on the special high-speed engines with which electric lighting stations are always provided; but to run arc lights with satisfactory results from an ordinary slow-speed engine, such as is common in factories, has not been possible with some of them.

The Waterhouse system has been perfected from power driven by a slow-speed engine, which is a great achievement in the results attained, reflecting credit upon the electrician of the company, whose long and successful experience in electric lighting has made him equal to the work to be accomplished.

It must be admitted that the dynamo electric machine (Fig. 1) is wonderful in its performances; and had the same machine been placed in comparison with those of, say, four years ago, it would have seemed an impossibility to have reached this present state of efficiency, and as compared to dynamos of the present day even, it seems impossible, yet we find it, weighing 1,200 lb., operating 20 arc lights with penetrating powers equal to the best 2,000 c. p. arc lights, having a current of high potential, running at slow speed, apparently doing nothing, because it is so noiseless, and without flashing at the commutator; governed by a new regulator, the distinguishing feature of which is that there is no possibility of the current increasing above the standard quantity, and thus all danger of overheating or destroying the machine is avoided.

It is run by a 4 inch belt, and when compared to dynamos requiring an 8 inch double belt to operate the same number of lights, the statement of the company that the Waterhouse system can be operated at a saving of power seems to be sustained. Fig. 2 represents the No. 1 lamp, upon which a patent has been issued allowing broad claims and not citing a case; and as this is in the magnetic principle for regulating the arc, it is a notable fact. A good working lamp is as essential in perfect lighting as a well regulated current, and the Waterhouse system seems to be favored in both of these.

Fig. 3 represents the No. 2 plain lamp, it being the purpose to make also the lamp of this pattern with highly ornamental finish. It differs entirely from the No. 1 in shape and construction, is also new in its magnetic principle, burns a beautiful long arc and has fine feeding powers, and is a very valuable addition to the system.

As we remarked, the penetrating power of the lights equals the best 2,000 candle power lights in use. They burn quiet and steady, and while the system is in every way suited for street lighting, it can be arranged for factory lighting in a way to annihilate the dark shadows; and as the light is quiet and steady and beautiful to work by, the Waterhouse system will, no doubt, receive its just share of the public favor.

Cleaning Stonework.

It is sometimes required to clean the surface of old masonry, which has become weathered or coated by deposits of dirt, either for the sake of appearance or to make a sound connection with new work. The only effectual method hitherto practiced for this purpose has been by completely redressing the surface with the chisel—a method which is tedious and costly at best, and which is seldom thoroughly carried out. A different and, it is claimed, more satisfactory process was devised by M. De Liebhabert, and used in 1884 for cleaning the walls of the quays of the Seine at Paris. These walls become in a few years covered with a black deposit, which resists acids. To remove it, a paste composed of a solution of soda and lime, to which a little chloride of lime is added, was mixed to the consistency of honey, and spread over the surface, where it was allowed to remain for two or three hours, according to the condition of the stone. When it was removed, the deposit was still black, but it had become sensitive to acids. After this preliminary treatment, a workman passed over the surface (with a large gutta-percha brush) a mixture called sulpho-chlorhydric, forming on the stone a kind of glue; and almost immediately afterward he syringed the surface with a jet of the same liquid. It formed an adherent paste, continuing to act upon the stone for about two or three hours. After the syringe came a gang of men who scrubbed the surface, finishing off with a hose pipe. The sulpho-chlorhydric mixture is composed of sulphuric and hydrochloric acids mixed empirically according to the nature of the stone and the necessities of the case. The cost of cleaning stone walls by this method in Paris is 46 centimes per square meter for material and 50 centimes for labor, by contract. The preliminary treatment by the caustic paste was paid for separately at 50 centimes per square meter. The total cost was consequently 1 fr. 46 c. (1 s. 2 d.) per square meter, or 1·3 d. per square foot. It is said that the stone itself is not damaged by this treatment, and soon regains its natural color.

Botanical Notes.

Influence of Light on Size of Leaves.—M. Ch. Flahault, in the *Annales des Sciences*, brings forward additional observations to support his view that, under equal conditions, the leaves of plants of the same species are larger in proportion as we go northward, these relatively larger dimensions being due to the duration of light of relatively feeble intensity. In cases where the chlorophyl is formed in the absence of light, it must be formed at the expense of the materials stored up in the tissues. The importance of these reservoirs of nutriment is still greater in the case of flowers. Thus, in the case of hyacinths, both blue and red, M. Flahault found no difference in the color of the flowers grown in the light or in the dark, the color being manufactured from the stores of material in the bulbs.

A Wonderful Tree.—Baron Ferd. Von Mueller says, in his "Eucalyptographia," that one of the grandest trees of the globe, and one of the greatest wonders in the whole creation of plants, is the *Eucalyptus diversicolor*. Astounding records of the height of this tree have been given. The Messrs. Muir saw trees with stems 300 feet high up to the first branch, and Baron Von Mueller himself noticed many which approached to 400 feet in their total height. When closely growing, the young trees may have a comparatively slender trunk, so much so that a tree 180 feet high may show a stem hardly more than a foot in diameter. In such a case the foliage, for want of space, is also only scantily developed, and the ramifications are but short in proportion to the tallness of the stems. In the mast-like straightness of the trunk and the smooth whiteness of its back, this superb tree indicates completely the variety *regnans* of *E. amygdalina*, of Southeast Australia, with which also, and perhaps solely, it enters into rivalry as the tallest tree of the globe. Even the loftiest trees may not have been found out yet in the secluded humid forest valleys in which *E. diversicolor*, like *E. amygdalina*, rejoices most and luxuriates to the greatest extent. But possibly in the 200 miles of uninterrupted length of *Sequoia* forests a few years ago rendered known to exist in Southern California, mammoth trees of *Sequoia Wellingtonia* or *S. sempervirens* may occur which possibly excel in stupendous height even the famous individual trees of the Calaveras grove.

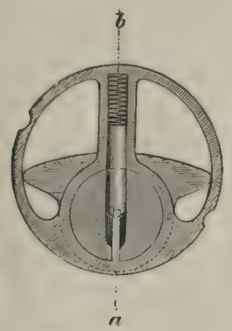
Big Trees of the West.—Case's "Botanical Index" gives the following record of some large trees growing in Indiana: *Chestnut.*—In Jackson County there are to be found the largest chestnut trees in the State. They are veritable giants, located about three miles southeast of Seymour. One of these measures 22 feet in circumference 2 feet above the ground, and the height to the first limb is 70 feet. *Sassafras.*—This tree attains a remarkable size on the Lower Wabash. One of these, one mile and a half west of Springfield, is fully 3 feet in diameter, and for more than 60 feet clear of limbs and knots. Its height in full is 85 feet. *Catalpa.*—In this same region and along the Wabash the catalpa grows slender and tall, and in great abundance. It is used for both fence rails and posts, and for durability stands next to the black locust. *Sycamore.*—The giant tree of Indiana, in all probability, is a sycamore in the White River bottom, not far from Worthington. It is said to be 48 feet in circumference, and has a solid trunk. At a height of 25 feet it branches into three or four limbs, one of which must be more than 5 feet in diameter. The tree is not quite round, but still it is quite regular.

An Interesting Botanical Fact has been discovered by M. Lemoine, of Nancy, who finds that the stigmas of double flowers are capable of fertilization by the pollen of single flowers, with the result of yielding seeds which in the majority of cases produce double flowers.

New Jersey is to publish a map of the whole State on the unusually large scale of five inches to the mile.

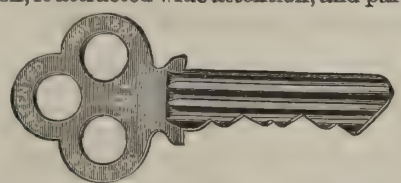
THE YALE LOCKS.

To baffle the ingenuity of the *chevalier d'industrie* and the curiosity of the impertinent is the mission of the lock-maker. While modern progress has permitted him to make many improvements, it has brought no fewer resources to the command of those who make his calling necessary. He must therefore be constantly on the alert to improve and perfect his mechanisms if he is to win in this battle with hidden antagonists.



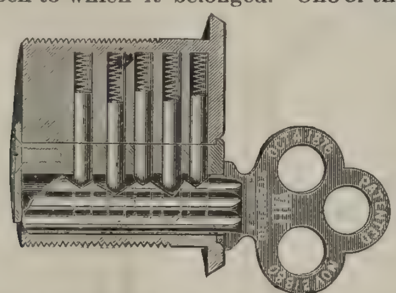
CROSS SECTION OF YALE LOCK—FLAT KEY.

It is related of the well-known Bramah lock, brought out some thirty odd years ago, that its manufacturers were sufficiently confident of the invulnerability of their lock to offer a reward of 200 guineas to any one who could open it. It fell to the good fortune of an American expert not only to be able to pick the lock, but afterward to open it three times within eight minutes. As this trial occurred at the time of the London Exhibition, it attracted wide attention, and particularly



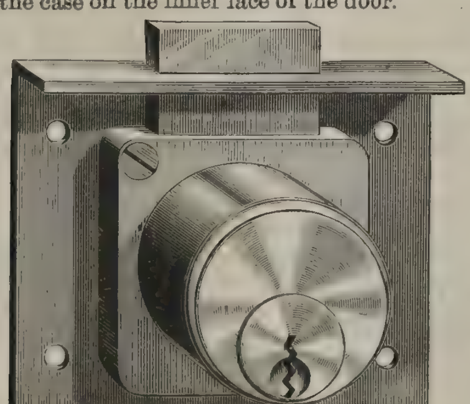
NEW YALE CORRUGATED KEY.

impressed American inventors with the necessity of more secure fastenings. Among these was Linus Yale, Jr., who worked for a number of years upon bank locks, but who finally turned his attention to perfecting the ordinary house lock, and invented the one which now bears his name and is so widely known. Previous to this time, the clumsy round key was in general use, and its size was made proportionate to the dimensions of the lock to which it belonged. One of the greatest



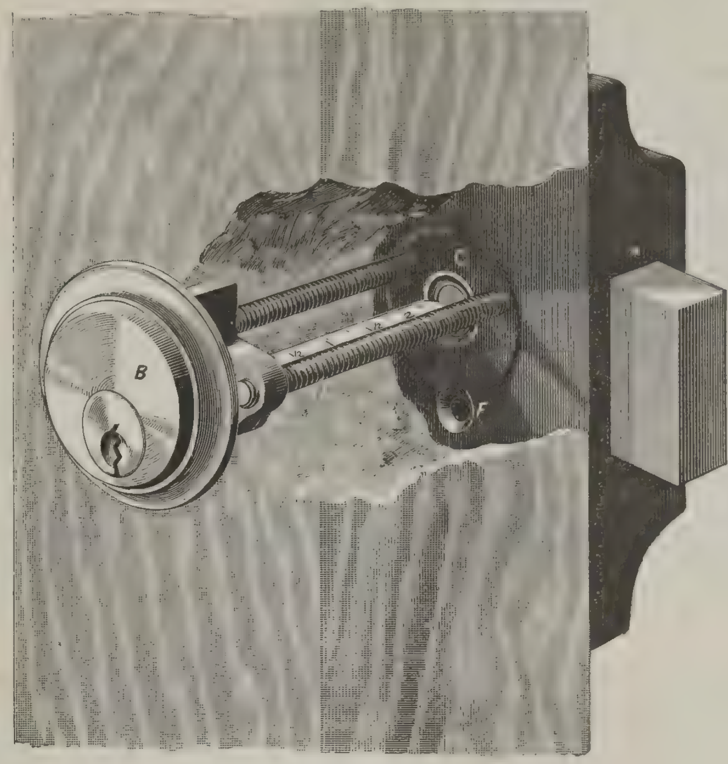
LONGITUDINAL SECTION OF YALE LOCK—CORRUGATED KEY.

improvements in Mr. Yale's invention, and second only to the increased protection afforded, was in the key. This has been reduced to a trifling weight and to a size which makes the vest pocket a convenient receptacle. The novelty in the lock itself consisted in separating the key mechanism from the bolt-containing case, and inclosing it in a separate shell or escutcheon inserted from the outside and connected permanently with the case on the inner face of the door.



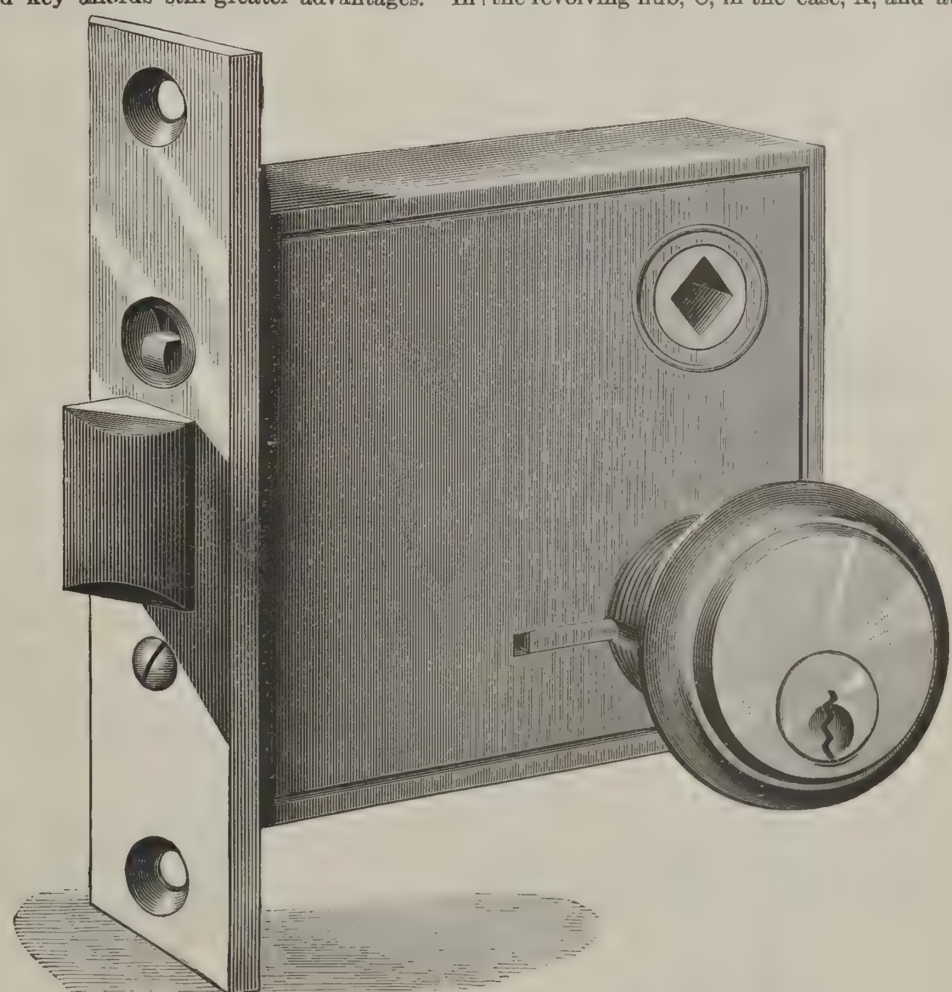
YALE DRAWER LOCK.

This construction permits a uniform size of keys for doors of all thicknesses. The arrangement of the key mechanism is shown in the sectional views. In the original Yale lock, as introduced about 1861, the key was made of sheet metal and perfectly flat. This is indicated in the cross section. In the improved form, however, the blade of the key is corrugated, as shown in the longitudinal section, and indicated by the keyhole in the perspective view. In both, the arrangement of the mechanism is the same. When the key is inserted in the hole, it raises the pins or tumblers to such heights that the joints between the two pins contained in each recess coincide exactly with the joint between the circular plug and its surrounding case, leaving the plug free to rotate and thus actuate the lock. When the key is withdrawn, the small brass springs press the pins to the bottom of their respective recesses, so that the upper pin in each recess crosses the joint of the plug and effectually prevents its motion. As the variation of one-fiftieth of an inch



YALE RIM LOCK.

in the depth of any one notch of a key will so alter it that it will not open the lock to which it belongs, it is evident that an immense variety of keys can be made without duplication, and that it would take a very nice workman to copy the key should it fall into dishonest hands. The function of the key in this lock is reduced to the mere setting of the tumblers and to performing the part of a handle by which to rotate the plug and actuate the boltwork. The improved corrugated key affords still greater advantages. In



YALE MORTISE NIGHT LATCH.

this form, tilting the key in the hole will be impossible, either from a weight such as a bunch of keys or otherwise, because the two are interlocked throughout their entire length, the key must go directly to its place, and the lock work smoothly at all times. No key ever heretofore made will fit or even enter one of the new locks, so that the users have absolute protection against accidental interchanging of keys.

Such is the Yale lock in general. There are now over four hundred varieties of sizes and styles made, one or two of the more important of which it may be of interest to note in detail. The Mortise Duplex Master Key Lock gives the additional convenience of two keys to the same lock. The master key operates the lock through the lower escutcheon only, and the change key through the upper one. In this manner the locks of a series may have different change keys for the use of office tenants, for example, and have the same master key for the use of the janitor. Any number of duplex locks, all with different change keys, can be made subject to one master key, and any number of master keys, each controlling its own series of locks, can be obtained. The Yale Rim Lock, shown in our illustration, is one which is readily put in place, but affords, nevertheless, perfect security. The case, A, containing the bolting mechanism, is screwed against the inner face of the door, while the escutcheon, B, is inserted in a hole bored through the door from the outside. The connecting bar, D, fits at one end into the revolving hub, C, in the case, A, and at the other end into a slot in the rear of the key plug of the escutcheon, B. The graduations show at what point the bar must be cut off in order to fit a certain thickness of door. Screws, E, fasten lock case and escutcheon together. Many other special forms are made. The drawer lock shown is excellent for securing money or valuable papers. The Yale locks are manufactured at Stamford, Conn., by the Yale & Towne Mfg. Co. They have now come into such general use, however, that they can be obtained from almost any hardware dealer.

JAPANESE HOUSE BUILDING.*

BY PROFESSOR EDWARD S. MORSE.

The first sight of a Japanese house—that is, a house of the people—is certainly disappointing. From the infinite variety and charming character of their various works of art, as we had seen them at home, we were anticipating new delights and surprises in the character of the house; nor were we on more intimate acquaintance to be disappointed. As an American, familiar with houses of certain types, with conditions among them signifying poverty and shiftlessness, and other conditions signifying refinement and wealth, we were not competent to judge the relative merits of a Japanese house.

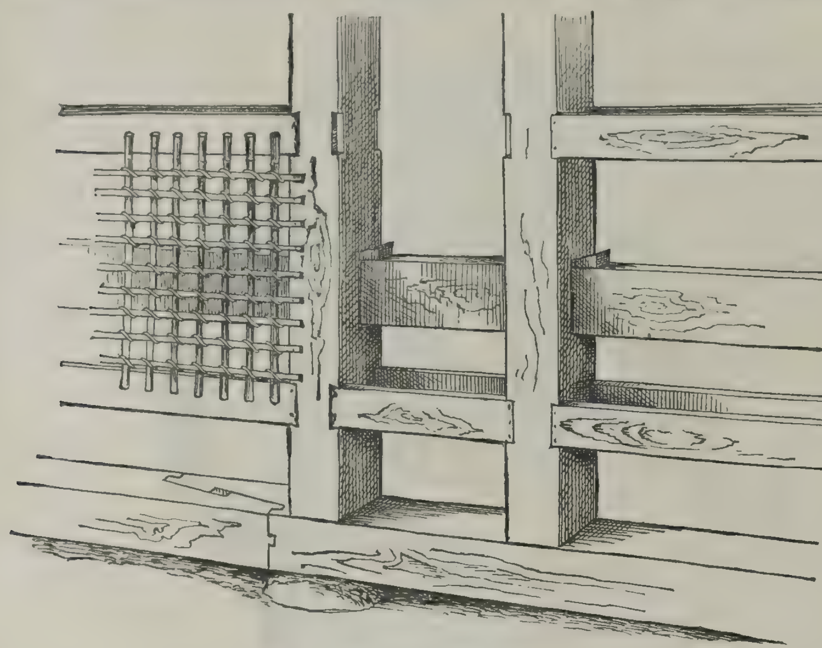


Fig. 1.—SIDE FRAMING.

Fig. 2.—POUNDING DOWN FOUNDATION STONES.

The first sight, then, of a Japanese house is disappointing; it is unsubstantial in appearance, and there is a meagerness of color. Being unpainted, it suggests poverty; and this absence of paint, with the gray and often rain-stained color of the boards, leads one to compare it with similar unpainted buildings at home—and these are usually barns and sheds in the country, and the houses of the poorer people in the city. With one's eye accustomed to the bright contrasts of American houses, with their white, or light, painted surfaces; rectangular windows, black from the shadows within, with glints of light reflected from the glass; front door with its pretentious steps and portico; warm red chimneys surmounting all, and a general trimness of appearance outside, which is by no means always correlated with like conditions within—one is too apt at the outset to form a low estimate of a Japanese house. An American finds it difficult indeed to consider such a structure as a dwelling, when so many features are absent that go to make up a dwelling at home—no doors or windows such as he had been familiar with; no attic or cellar; no chimneys, and within no fireplace, and of course no customary mantel; no permanently inclosed rooms; and, as for furniture, no beds or tables, chairs or similar articles—at least, so it appears at first sight.

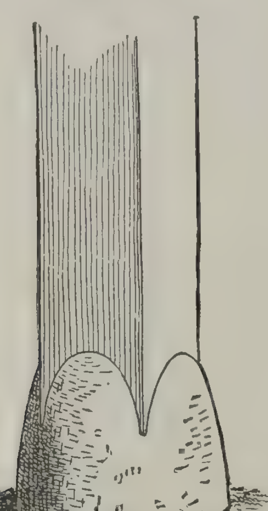


Fig. 3.—FOUNDATION STONE.

One of the chief points of difference in a Japanese house, as compared with ours, lies in the treatment of partitions and outside walls. In our houses these are solid and permanent, and when the frame is built, the partitions form part of the framework. In the Japanese house, on the contrary, there are two or more sides that have no permanent walls. Within, also, there are but few partitions which have similar stability; in their stead are slight sliding-screens, which run in appropriate grooves in the floor and overhead. These grooves mark the limit of each room. The screens may be opened by sliding them back or they may be entirely removed, thus throwing a number of rooms in to one great apartment. In the same way the whole side of a house may be flung open to sunlight and air. For communication between the rooms, therefore, swinging-doors are not necessary. As a substitute for windows, the outside screens, or *shoji*, are covered with white paper, allowing the light to be diffused through the house.

Fig. 5.—END FRAMING OF LARGE BUILDING.

Where external walls appear, they are of wood unpainted or painted black, and, if of plaster, white or dark slate colored. In certain classes of building the outside wall, to a height of several feet from the ground, and sometimes even the entire wall, may be tiled, the interspaces being pointed with white plaster. The roof may be either lightly shingled, heavily tiled, or thickly thatched. It has a moderate pitch, and, as a general thing, the slope is not so steep as in our roofs.

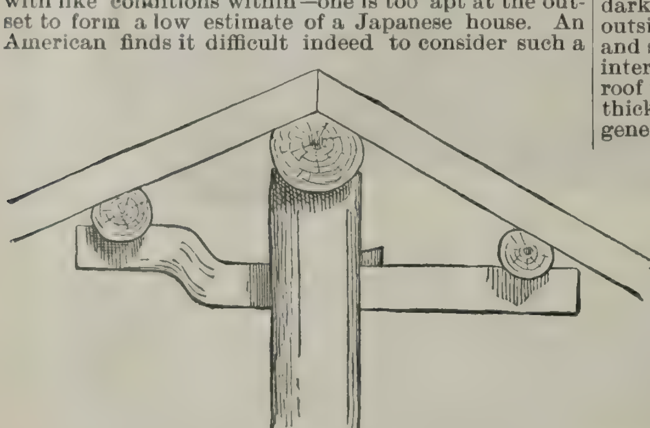


Fig. 4.—SECTION OF FRAMING.

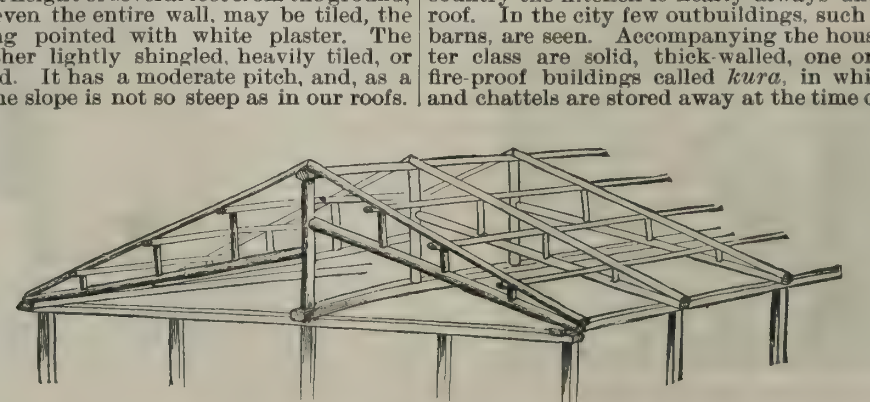


Fig. 6.—ROOF FRAME OF LARGE BUILDING.

Nearly all the houses have a veranda, which is protected by the widely overhanging eaves of the roof, or by a light supplementary roof projecting from beneath the eaves.

While most houses of the better class have a definite porch and vestibule, or *genka*, in houses of the poorer class this entrance is not separate from the living room; and, since the interior of the house is accessible from two or three sides, one may enter it from any point. The floor is raised a foot and a half or more from the ground, and is covered with thick straw mats, rectangular in shape, of uniform size, with sharp, square edges, and so closely fitted that the floor upon which they rest is completely hidden. The rooms are either square or rectangular, and are made with absolute reference to the number of mats they are to contain. With the exception of the guest-room, few rooms have projections or bays. In the guest-room, there is at one side a more or less deep recess divided into two bays by a slight partition; the one nearest the veranda is called the *tokonoma*. In this place hang one or more pictures, and upon its floor, which is slightly raised above the mats, rests a flower vase, incense burner, or some other object. The companion bay has shelves and a low closet. Other rooms also may have recesses to accommodate a case of drawers or shelves. Where closets and cupboards occur, they are finished with sliding screens instead of swinging-doors. In tea-houses of two stories, the stairs, which often ascend from the vicinity of the kitchen, have beneath them a closet, and this is usually closed by a swinging door.

In city houses the kitchen is at one side or corner of the house, generally in an L, covered with a pent roof. This apartment is often toward the street, its yard separated from other areas by a high fence. In the country the kitchen is nearly always under the main roof. In the city few outbuildings, such as sheds and barns, are seen. Accompanying the houses of the better class are solid, thick-walled, one or two storied, fire-proof buildings called *kura*, in which the goods and chattels are stored away at the time of a conflagration. These buildings, which are known to the foreigners as "godowns," have one or two small windows and one door, closed by thick and ponderous shutters. Such a building usually stands isolated from the dwelling, though often in juxtaposition; and sometimes, though rarely, it is used as a domicile.

In the gardens of the better classes, summer houses and shelters of rustic appearance and diminutive proportions are often seen. Rustic arbors are also to be seen in the larger gardens. Specially constructed

* From "Japanese Homes and their Surroundings." By Edward S. Morse, Director of the Peabody Academy of Science; Late Professor of Zoology, University of Tokio, Japan; Member of the National Academy of Science; Fellow of the American Academy of Arts and Sciences, etc. With Illustrations by the Author. Boston: Ticknor & Co. 1886.

houses of quaint design and small size are not uncommon; in these the ceremonial tea-parties take place. High fences, either of board or bamboo, or solid walls of mud or tile with stone foundations, surround the house or inclose it from the street. Low rustic fences border the gardens in the suburbs. Gateways of various styles, some of imposing design, form the entrances; as a general thing, they are either rustic and light, or formal and massive.

Whatever is commonplace in the appearance of the house is toward the street, while the artistic and picturesque face is turned toward the garden, which may be at one side or in the rear of the house—usually in the rear. Within these plain and unpretentious houses there are often to be seen marvels of exquisite carving and the perfection of cabinet-work; and surprise follows surprise as one becomes more fully acquainted with the interior finish of these curious and remarkable dwellings.

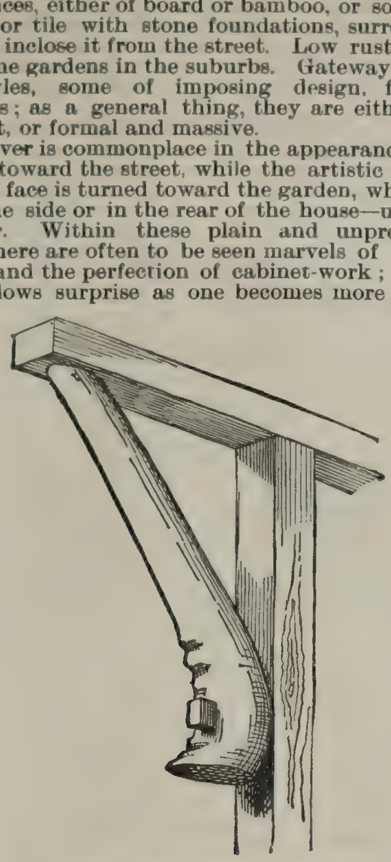


Fig. 7.—OUTSIDE BRACE.

The framework of an ordinary Japanese dwelling is simple and primitive in structure; it consists of a number of upright beams which run from the ground to the transverse beams and inclines of the roof above. The vertical framing is held together either by short strips, which are let into appropriate notches in the uprights to which the bamboo lathing is fixed, or by longer strips of wood, which pass through mortises in the uprights, and are firmly keyed or pinned into place (Fig. 1). In larger houses these uprights are held in position by a framework near the ground. There is no cellar or excavation beneath the house, nor is there a continuous stone foundation as with us. The uprights rest directly, and without attachment, upon single uncut or rough hewed stones, these in turn resting upon others, which have been solidly pounded into the earth by means of a huge wooden maul worked by a number of men (Fig. 2). In this way the house is perched upon these stones, with the floor elevated at least a foot and a half or two feet above the ground. In some cases the space between the uprights is boarded up; this is generally seen in Kioto houses. In others the wind has free play beneath; and, while this exposed condition renders the house much colder and more uncomfortable in winter, the inmates are never troubled by the noisome air of the cellar, which too often infects our houses at home. Closed wooden fences of a more solid character are elevated in this way; that is, the lower rail or sill of the fence rests directly upon stones placed at intervals apart of six or eight feet. The ravages of numerous ground insects, as well as larvæ, and the excessive dampness of the ground at certain seasons of the year, render this method of building a necessity.

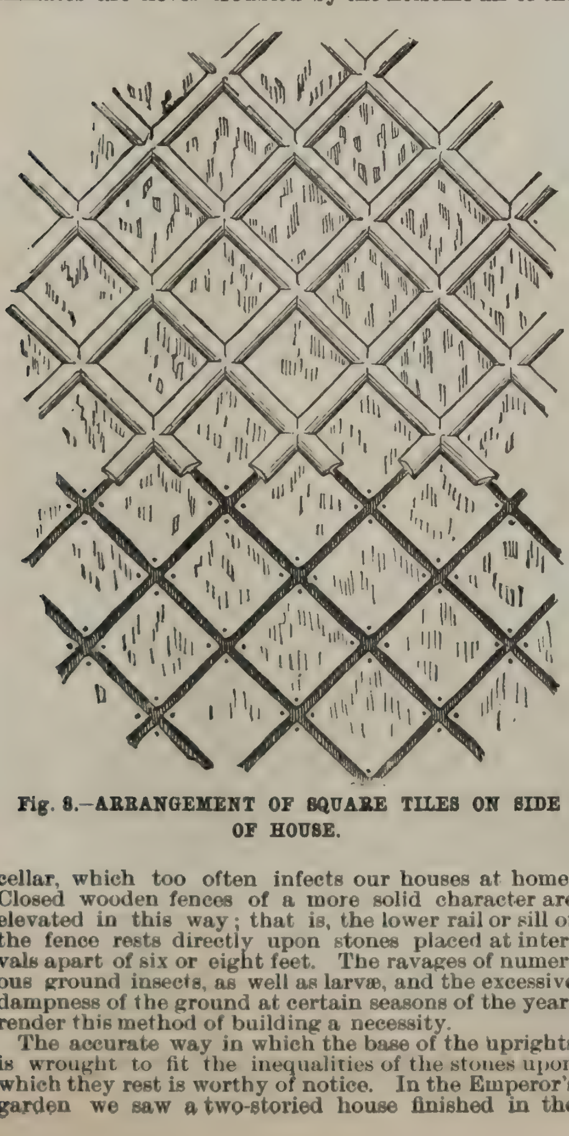


Fig. 8.—ARRANGEMENT OF SQUARE TILES ON SIDE OF HOUSE.

The accurate way in which the base of the uprights is wrought to fit the inequalities of the stones upon which they rest is worthy of notice. In the Emperor's garden we saw a two-storied house finished in the most simple and exquisite manner. It was, indeed, like a beautiful cabinet, though disfigured by a bright colored foreign carpet upon its lower floor. The uprights of this structure rested on large, oval, beach-worn stones buried endwise in the ground; and, upon the smooth rounded portions of the stones, which projected above the level of the ground to a height of ten inches or more, the uprights had been most accurately fitted (Fig. 3). The effect was extremely light and buoyant, though apparently insecure to the last degree; yet this building had not only withstood a number of earthquake-shocks, but also the strain of severe typhoons, which during the summer months sweep over Japan with such violence. If the building be very small, then the frame consists of four corner posts running to the roof. In dwellings having a frontage of two or more rooms, other uprights occur between the corner posts. As the rooms increase in number through the house, uprights come in the corners of the rooms, against which the sliding-screens, or *fusuma*, abut. The passage of these uprights through the room to the roof above gives a solid constructive appearance to the house. When a house has a veranda—and nearly every house possesses this feature on one or more of its sides—another row of uprights starts in a line with the outer edge of the veranda. Unless the veranda be very long, an upright at each end is sufficient to support the supplementary roof which shelters it. These uprights support a cross beam, upon which the slight rafters of the supplementary roof rest. This cross beam is often a straight unhewed stick of timber, from which the bark has been removed. Indeed, most of the horizontal framing timbers, as well as the rafters, are usually unhewn—the rafters often having the bark on, or perhaps being accurately squared sticks; but, in either case, they are always visible as they project from the sides of the house, and run out to support the overhanging eaves. The larger beams and girders are but slightly hewed; and it is not unusual to see irregular-shaped beams worked into the construction of a frame, often for their quaint effects (Fig. 4), and in many cases as a matter of economy.

Fig. 9.—STREET IN KANDA KU TOKIO.

For a narrow house, if the roof be a gable, a central upright at each end of the building gives support to the ridge pole from which the rafters run to the eaves. If the building be wide, a transverse beam traverses the end of the building on a level with the eaves, supported at intervals by uprights from the ground; and upon this short uprights rest, supporting another transverse beam above, and often three or more tiers are carried nearly to the ridge. Upon these supports rest the horizontal beams which run parallel with the ridge-pole, and which are intended to give support to the rafters (Fig. 5).

In the case of a wide gable-roof there are many ways to support the frame, one of which is illustrated in the following outline (Fig. 6). Here a stout stick of timber runs from one end of the house to the other on a vertical line with the ridge-pole, and on a level with the eaves. This stick is always crowning, in order to give additional strength. A few thick uprights start from this to support the ridge-pole above; from these uprights beams run to the eaves; these are mortised into the uprights, but at different levels on either side, in order not to weaken the uprights by the mortises. From these beams run short supports to the horizontal rafters above.

Fig. 10.—STREET VIEW OF DWELLING IN TOKIO.

The roof, if it be of tile or thatch, represents a massive weight—the tiles being thick and quite heavy, and always bedded in a thick layer of mud. The thatch, though not so heavy, often becomes so after a long rain. The roof framing, consequently, has oftentimes to support a great weight; and, though in its structure looking weak, or at least primitive in design, yet experience must have taught the Japanese carpenters that their methods were not only the simplest and most economical, but that they answered all requirements. One is amazed to see how many firemen can gather upon such a roof without its yielding. I have seen massive house-roofs over two hundred years old, and other frame structures of a larger size and of far greater age, which presented no visible signs of weakness. Indeed, it is a very unusual sight to see a broken-backed roof in Japan.

Diagonal bracing in the framework of a building is never seen. Sometimes, however, the uprights in a weak frame are supported by braces running from the ground at an acute angle, and held in place by wooden pins. Outside diagonal braces are sometimes met with as an ornamental feature. In the province of Ise one often sees a brace or bracket made out of an unhewed piece of timber generally the proximal portion of some big branch. This is fastened to an upright, and appears to be a brace to hold up the end of a horizontal beam that projects beyond the eaves. These braces, however, are not even notched into the upright, but held in place by square wooden pins, and are of little use as a support for the building, though answering well to hold fishing-rods and other long poles, which find here convenient lodgment (Fig. 7).

The framework of a building is often revealed in the room in a way that would delight the heart of an Eastlake. Irregularities in the form of a stick are not looked upon as a hindrance in the construction of a building. From the way such crooked beams are brought into use, one is led to believe that the builder prefers them. The desire for rustic effects leads to the selection of odd-shaped timber. Fig. 4 represents the end of a room, wherein is seen a crooked cross piece passing through a central upright, which sustains the ridge-pole.

As the rooms are made in sizes corresponding to the number of mats they are to contain, the beams, uprights, rafters, flooring-boards, boards for the ceiling, and all strips are got out in sizes to accommodate these various dimensions. The dimensions of the mats from one end of the empire to the other are approximately 3 feet wide and 6 feet long; and these are fitted compactly on the floor. The architect marks on his plan the number of mats each room is to contain—this number defining the size of the room; hence, the lumber used must be of definite lengths, and the carpenter is sure to find these lengths at the lumber yard. It follows from this that but little waste occurs in the construction of a Japanese house.

The permanent partitions within the house are made in various ways. In one method, bamboo strips of various lengths take the place of laths. Small bamboos are first nailed in a vertical position to the wooden strips, which are fastened from one upright to another; narrow strips of bamboo are then secured across these bamboos by means of coarse cords of straw, or bark fiber (Fig. 1). This partition is not unlike our own plaster-and-lath partition. Another kind of partition may be of boards; and against these small bamboo rods are nailed quite close together, and upon this the plaster is put. Considerable pains are taken as to the plastering. The plasterer brings to the house samples of various-colored sands and clays, so that one may select from these the color of his wall. A good coat of plaster comprises three layers. The first layer, called *shita-nuri*, is composed of mud, in which chopped straw is mixed; a second layer, called *chu-nuri*, of rough lime, mixed with mud; the third layer, called *uwa-nuri*, has the colored clay or sand mixed with lime—and this last layer is always applied by a skillful workman.

Many of the partitions between the rooms consist entirely of light sliding-screens. Often two or more sides of the house are composed entirely of these simple and frail devices. The outside permanent walls

of a house, if of wood, are made of thin boards nailed to the frame horizontally—as we lay clapboards on our houses. These may be more firmly held to the house by long strips nailed against the boards vertically. The boards may also be secured to the house vertically, and weather strips nailed over the seams—as is commonly the way with certain of our houses. In the southern provinces a rough house-wall is made of wide slabs of bark, placed vertically, and held in place by thin strips of bamboo nailed crosswise This style is common among the poorer houses in Japan; and, indeed, in the better class of houses it is often used as an ornamental feature, placed at the height of a few feet from the ground.

Outside plastered walls are also very common, though not of a durable nature. This kind of wall is frequently seen in a dilapidated condition. In Japanese

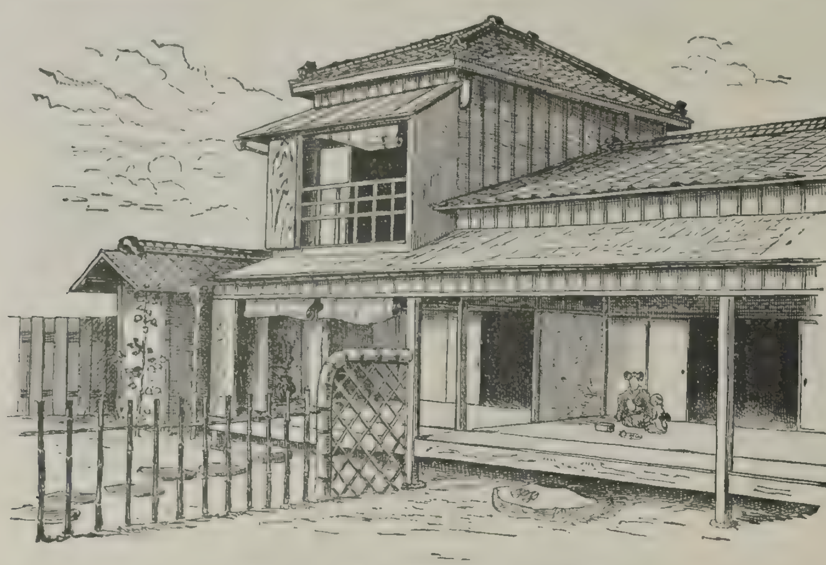


Fig. 11.—VIEW OF DWELLING FROM GARDEN IN TOKIO.

picture books this broken condition is often shown, with the bamboo slats exposed, as a suggestion of poverty.

In the cities the outside walls of more durable structures, such as warehouses, are not infrequently covered with square tiles, a board wall being first made, to which the tiles are secured by being nailed at their corners. These may be placed in diagonal or horizontal rows—in either case an interspace of a quarter of an inch being left between the tiles, and the seams closed with white plaster, spreading on each side to the width of an inch or more, and finished with a rounded surface. This work is done in a very tasteful and artistic manner, and the effect of the dark-gray tiles crossed by these white bars of plaster is very striking (Fig. 8).

The Japanese dwellings are always of wood, usually of one story, and unpainted. Rarely does a house strike one as being specially marked or better looking than its neighbors; more substantial, certainly, some of them are, and yet there is a sameness about them which becomes wearisome. Particularly is this the case with the long, uninteresting row of houses that border a village street; their picturesque roofs alone save them from becoming monotonous. A closer study, however, reveals some marked differences between the country and city houses, as well as between those of different provinces.

The country house, if anything more than a shelter from the elements, is larger and more substantial than the city house, and, with its ponderous thatched roof and elaborate ridge, is always picturesque. One sees much larger houses in the north—roofs of grand proportions and amplitude of space beneath that farther south occurs only under the roofs of temples. We

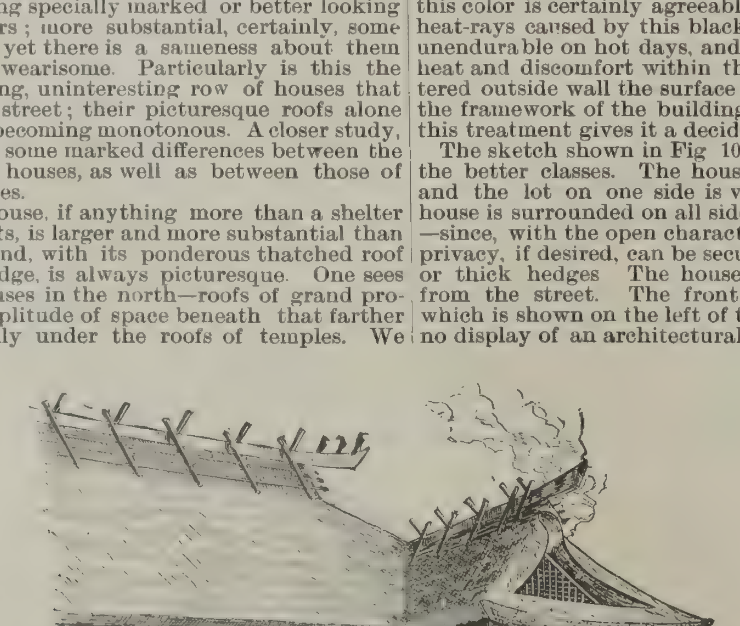


Fig. 12.—OLD FARMHOUSE IN KABUTOYAMA.

speak now of the houses of the better classes, for the poor farm laborer and fisherman, as well as their prototypes in the city, possess houses that are little better than shanties, built, as a friend has forcibly expressed it, of "chips, paper, and straw." But even these huts, clustered together as they oftentimes are in the larger cities, are palatial in contrast to the shattered and filthy condition of a like class of tenements in many of the cities of Christian countries.

In traveling through the country, the absence of a middle class, as indicated by the dwellings, is painfully apparent. It is true that you pass, now and then, large, comfortable houses with their broad thatched roofs, showing evidences of wealth and abundance in the numerous *kura* and outbuildings surrounding them; but, where you find one of these, you pass hundreds which are barely more than shelters for their inmates, and, within, the few necessary articles render the evidences of poverty all the more apparent.

Though the people that inhabit such shelters are very poor, they appear contented and cheerful notwithstanding their poverty. Other classes, who, though not poverty-stricken, are yet poor in every sense of the word, occupy dwellings of the simplest character. Many of the dwellings are often diminutive in size; and, as one looks in at a tiny cottage containing two or three rooms at the most, the entire house hardly bigger than a good-sized room at home, and observes a family of three or four persons living quietly and in a cleanly manner in this limited space, he learns that in Japan, at least, poverty and constricted quarters are not always correlated with coarse manners, filth, and crime.

The accompanying sketch (Fig. 9) represents a group of houses bordering a street in Kanda Ku, Tokio. The windows are in some cases projecting or hanging bays, and are barred with bamboo or square bars of wood. A sliding-screen, covered with stout white paper, takes the place of our glass-windows. Through these gratings the inmates of the house do their bargaining with the street venders. The entrance to these houses is usually by means of a gate, common to a number. This entrance consists of a large gate used for vehicles and heavy loads, and by the side of this is a smaller gate used by the people. Sometimes the big gate has a large square opening in it, closed by a sliding-door or grating—and through this the inmates have ingress and egress.

The houses, if of wood, are painted black; or else, as is more usually the case, the wood is left in its natural state, and this gradually turns to a darker shade by exposure. When painted, a dead black is used; and this color is certainly agreeable to the eyes, though the heat-rays caused by this black surface become almost unendurable on hot days, and must add greatly to the heat and discomfort within the house. With a plastered outside wall the surface is often left white, while the framework of the building is painted black—and this treatment gives it a decidedly funereal aspect.

The sketch shown in Fig 10 is a city house of one of the better classes. The house stands on a new street, and the lot on one side is vacant; nevertheless, the house is surrounded on all sides by a high board-fence—since, with the open character of a Japanese house, privacy, if desired, can be secured only by high fences or thick hedges The house is shown as it appears from the street. The front door is near the gate, which is shown on the left of the sketch There is here no display of an architectural front; indeed, there is no display anywhere. The largest and best rooms are in the back of the house; and what might be called a back-yard, upon which the kitchen opens, is parallel with the area in front of the main entrance to the house, and separated from it by a high fence. The second story contains one room, and this may be regarded as a guest-chamber. Access to this chamber is by means of a steep flight of steps, made out of thick plank, and unguarded by hand-rail of any kind. The roof is heavily tiled, while the walls of the house are outwardly composed of broad thin boards, put on vertically, and having strips of wood to cover the joints. A back view of this house is shown in Fig. 11. Here all the rooms open directly on the garden. Along the veranda are three rooms *en suite*. The balcony of the second story is covered by a light supplementary roof, from which hangs a bamboo screen to shade the room from the sun's rays. Similar screens are also seen hanging below.

The veranda is quite spacious; and in line with the division between the rooms is a groove for the adjustment of a wooden screen or shutter when it is desired to separate the house into two portions temporarily. At the end of the veranda, to the left of the sketch, is the latrine. The house is quite open beneath, and the air has free circulation.

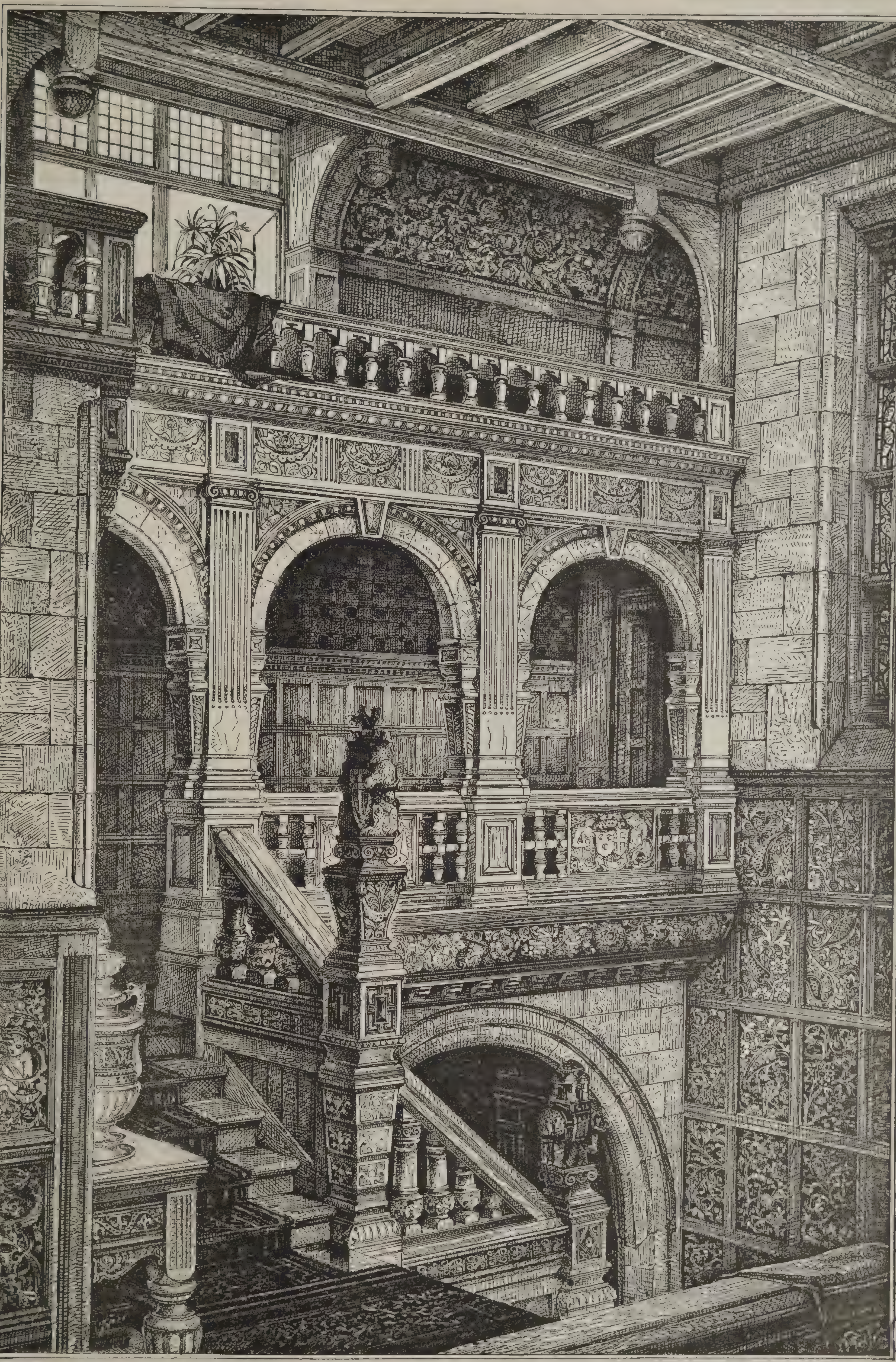
The country house of an independent *samurai* or rich farmer, is large, roomy, and thoroughly comfortable. I recall with the keenest pleasure the delightful days enjoyed under the roof of one of these typical mansions in Kabutoyama, in the western part of the province of Musashi. The residence consisted of a group of buildings shut in from the road by a high wall. Passing through a ponderous gateway, one enters a spacious court-yard, flanked on either side by long, low buildings, used as store-houses and servants' quarters. At the farther end of the yard, and facing the entrance, was a comfortable old farm-house, having a projecting gable-wing to its right (Fig. 12). The roof was a thatched one of unusual thickness. At the end of the wing was a triangular latticed opening, from which thin blue wreaths of smoke were curling. This building contained a few rooms, including an unusually spacious kitchen. The kitchen opened directly into a larger and unfinished portion of the house, having the earth for its floor, and used as a wood-shed. The owner informed me that the farmhouse was nearly three hundred years old. To the left of the building was a high wooden fence, and, passing through a gateway, one came into a smaller yard and garden. In this area was another house quite independent of the farmhouse; this was the house for guests. Its conspicuous feature consisted of a newly thatched roof, surmounted by an elaborate and picturesque ridge—its design derived from temple architecture. Within were two large rooms opening upon a narrow veranda. These rooms were unusually high in stud, and the mats and all the appointments were most scrupulously clean. Communication with the old house was by means of a covered passage. Back of this dwelling, and some distance from it, was still another house, two stories in height, and built in the most perfect taste; and here lived the grandfather of the family—a fine old gentleman, dignified and courtly in his manners.—*Popular Science Monthly.*

The Ancient Cities of Chaldea.

Mr. W. St. Chad Boscawen lately delivered at the British Museum lectures on the "History and Antiquities of Ancient Assyria and Chaldea," the subject being Babylon as a City of Temples. Mr. Boscawen remarked that Babylon was one of the ancient cities of Mesopotamia, round whose ruins tradition had always lingered, and upon whose site the name of Babel had always found a representative. In both Hebrew and Arabic tradition, writers have located the ancient city of Nimrod in the group of mounds to the north-east of Chaldea, the chief of which bore the name of Babel. The lecturer narrated the descriptions of the site given by some of the earlier writers, chief among whom were the Jewish traveler Benjamin of Tudela, who visited the ruins in 1165, and the English traveler John Eldred. The first European traveler who made known the features of the ruins of Babylon was Claudius Rich, the English resident at Bagdad, who in the early part of the present century visited and described the site in a memoir full of most valuable topographical details Mr. Boscawen then proceeded to describe the chief features of the site, the remains of the city walls and gates, and the Babel Kasr, and Mujelibe mounds, and to show how these tended to curtail the extravagant accounts of the Greek writers. It was to Mr. Rassam that the merit belonged of the first discoveries that enabled us to locate some of the chief edifices, and thus to gain a starting point in the reconstruction of the topography of the ancient city. By his explorations in 1880 he had shown that the Babel mound was the site of the palace to which the Bhugong Gardens were attached, the discovery being confirmed by the traces of extensive hydraulic works. A slab found on the Kasr mound marked it as the site of the palace, as it bore the inscription, "The Palace of Nebuchadnezzar;" while the Mujelibe mound was the spot on which the chief government offices were placed, as it was here that the celebrated Egibi tablets were found. The lecturer proceeded then to consider the ancient names of the city as found in the inscriptions. The earliest and most important was the Akkadian form Ka-Dimmira, "The gate of God." This name, both in its Semitic and non-Semitic form, is found on the earliest bricks, and its etymology is so clear that the explanation given in Genesis, as meaning "confusion," was no longer tenable. On a small tablet there was recorded, though in a mutilated form, the tradition that the Babylonians, under a wicked king, rebelled against the gods and built a tower. As fast as they built the gods overthrew, and at last, to impede the work, they determined to "confound their speech." Mr. Boscawen next dealt with the inscriptions relating to the shrine of Bel, the temple of Belus in Babylon. The records of repairs of this temple were numerous. One of the earliest of these was one of the King Khammurabi, dating from about the time of the Abramic migration, which recorded the erection of the holy place of the god. There was in existence an inscription which gave the dimensions of every shrine in the temple, and from which the lecturer had been able to reconstruct a plan of the great temple. Mr. Boscawen concluded with a *résumé* of the history of the temple during the Persian and Greek periods of rule.

Winking Photographs.

Winking photographs are said to be produced in the following manner: One negative is taken with the sitter's eyes open; another without change of position, with the eyes shut. The two negatives are printed on opposite sides of the paper, "registering" exactly. Held before a flickering lamp, or other variable source of light, the combined photographs show rapid alternations of closed and open eyes, the effect being that of rapid winking.



STAIR CASE IN THE JACOBEAN STYLE.

STAIR CASE, JACOBEAN STYLE.

In continuance of our series of suggestions in Art designing we give a Staircase in the Jacobean style, for which we are indebted to the *Building News*. The author of this design is Mr. B. J. Talbert, of London, and the original drawing, which was exhibited at the Royal Academy.

INDIAN CORN AS FOOD FOR MAN.

Corn is the most widely-cultivated grain in the world with the exception of rice. The three great articles of human food are wheat, corn and rice. Wheat is principally produced in temperate countries and is not grown to a large extent in very hot regions; rice is the product and food of hot countries only; while corn, though a tropical plant, grows equally as well in such temperate regions as have a sunny clime. The warmest regions of the torrid zone produce corn in abundance, giving three crops in a single year; and yet so short is the season required for its development that even the hot sun of Canada's limited Summer suffices to bring it to perfection.

As to nutritive matter corn is only exceeded by wheat and followed by rice among the leading articles of food. Indian meal contains less water than wheat flour, more albumen, four times the quantity of fat, more nitrogen and available carbon, an equal quantity of salts, and is slightly deficient in starch, and still more so in sugar. On account of its lack of gluten it is not well adapted for making bread without a slight admixture of wheat or rye flour, but for cakes, to be eaten soon after cooking, for puddings and the like, it is very palatable. Calculated according to the physiological wants of the system, a week's diet for an adult would only cost about twenty cents, and, excepting split peas, there is nothing approaching corn for economy. Corn meal would be more extensively used among all classes if its manufacture was conducted with as much skill and care as is devoted to wheat and oats, and if it could be obtained pure and sweet, and that man will be a public benefactor who shall devise some method of presenting its nutritious qualities in a palatable and accepted form.

Even in the United States, where thirty-seven million acres are devoted to the culture of Indian corn, yielding a total product of thirteen hundred million bushels, while the wheat crop of the world is only seven hundred and sixty million bushels, we only understand the economic value of corn as cattle food, as a prime factor in prime beef and a plentiful supply of pork. In this respect even we are groping in the dark, for no thorough analyses of our varieties of corn have ever been made; and while some kinds are far more desirable than others even as food for man, our knowledge on the subject is extremely limited. Granting for argument's sake that wheat contains eighteen per cent more nutritive matter than corn, then if a bushel of wheat is worth one dollar, the same weight of corn should sell at eighty-two cents; yet to-day, while the average price of wheat at the seaboard is two dollars per bushel, that of corn is sixty-five cents. Either wheat is too high or corn is too low. In buying wheat flour the same outlay would purchase double the amount of nutriment in Indian meal.

The prejudice against the use of corn as an article of human food is based on ignorance in many cases, and on false pride in others. Wheat is most agreeable to the taste, and is preferred by a greater portion of the human family, or, at least, by those who are able to purchase it. While all the world is familiar with wheat as an article of food, not one-tenth of its population ever heard of Indian corn except as cattle food. It is quite remarkable that notwithstanding its acknowledged good qualities and its economy, yet it is but little known to the people of those portions of Europe to whom cheap food is an absolute necessity; and even in times of famine it has required judicious and persistent governmental efforts to induce famishing communities to use it. The introduction of Indian corn has been comparatively slow, since it seems difficult to displace wheat so long as it can be obtained; yet it is certain that a few years hence will witness an enormous demand, resulting from a popular appreciation of this cheap and wholesome staple, and a diminished purchasing power among the masses in Europe.

England imports 75,000,000 bushels annually at a cost of $51,000,000; India is raising enormous quantities, now universally consumed as human food; Brazil cultivates the crop largely, esteeming it nutritious and wholesome; Italy annually raises 45,000,000 bushels; Austria, 80,000,000 bushels; Hungary, 66,000,000; France, 30,000,000; Portugal, 15,000,000; Greece, 3,000,000; New South Wales, 1,000,000. Since the famine of 1846 in Ireland, its use is established in Great Britain. Germany is annually consuming increased quantities; it enters largely into the food of America, Natal, Italy, Spain, the south of France, the Danubian principalities, Mexico, Africa, Turkey, Egypt, India, China, and many other nations. Forming so large an element in our annual crops, and possessed of a soil and climate unrivalled in its production, Indian corn will in the near future assume still greater proportions as an article of American growth and export.—*Boston Cultivator.*

[Scientific Farmer.]

UTILIZATION OF DEAD ANIMALS.

During the winter quite a large number of my domestic animals died, and the work of composting was at once begun. The *modus operandi* was as follows: A convenient location being first selected, the site of the compost was prepared by throwing the soil up to the height of 8 or 10 inches. The dead animals being first skinned, the flesh and bones were cut up into small pieces with knives and axes. The formation of the compost was then commenced by putting down a layer of wood mould to the depth of about six inches. Then followed a layer of bones and flesh, and upon this was added six inches of strong, fresh stable manure; then another layer of wood mould, and so on until the job was finished. The several additions that were afterwards made to the heap as an animal died were done in the same way, and the whole was secured from the depredations of hogs and dogs by a high rail fence. In the spring, when ready to haul out this compost, having to leave home for a day or two, I directed my hands to take care of all the bones, intending to get some sulphuric acid to decompose them with. When I returned home I went to the compost, where the hands were still employed in carting it to the field. I enquired of them what had been done with the bones. They replied that only a very small quantity had been found; less than a peck. Upon examination of what was left of the heap I found that the bones had been almost entirely decomposed. Since that time I have been in the habit of making compost of all my dead animals, with similar results. They make a most excellent manure and a great deal of it. A large, fat horse will make from ten to twelve loads. Generally it takes about three months to decompose the bones when thus composted; but when the animals are young and the bones tender, it may be done in six months. Ten years ago I lost a young ox about April 1st; I had it put in a compost, and about the 15th of May I found the bones entirely decomposed. I am in the habit of gathering up all the bones from the household and on the farm, and composting them in like manner with the dead animals, first breaking them up into small pieces.

William Holman.

[Nature.]

JAPANESE MIRRORS.

A short time ago a friend showed me a curious effect, which I had previously heard of, but had never seen. The ladies of Japan use, in making their toilet, a small round mirror about $\frac{1}{10}$ to $\frac{1}{8}$ inch in thickness, made of a kind of speculum metal, brightly polished and coated with mercury. At the back there are usually various devices, Japanese or Chinese written characters, badges, etc., standing in strong relief, and brightly polished like the front surface. Now if the direct rays of the sun are allowed to fall upon the front of the mirror and are then reflected on to a screen, in a great many cases, though not in all, the figures at the back will appear to shine through the substance of the mirror as bright lines upon a moderately bright ground.

I have since tried several mirrors as sold in the shops, and in most cases the appearance described has been observed with more or less distinctness.

I have been unable to find a satisfactory explanation of this fact, but on considering the mode of manufacture I was led to suppose that the pressure to which the mirror was subjected during polishing, and which is greatest on the parts in relief, was concerned in the production of the figures. On putting this to the test by rubbing the back of the mirror with a blunt pointed instrument, and permitting the rays of the sun to be reflected from the front surface, a bright line appeared in the image corresponding to the position of the part rubbed. This experiment is quite easy to repeat, a scratch with a knife or with any other hard body is sufficient. It would seem as if the pressure upon the back during polishing caused some change in the reflecting surface corresponding to the raised parts, whereby the amount of light reflected was greater; or supposing that of the light which falls upon the surface, a part is absorbed and the rest reflected, those parts corresponding to the raised portions on the back are altered by the pressure in such a way that less is absorbed, and therefore a bright image appears. This, of course, is not an explanation of the phenomenon, but I put it forward as perhaps indicating the direction in which a true explanation may be looked for.

The following account of the manufacture of the Japanese mirrors is taken from a paper by Dr. Geerts, read before the Asiatic Society of Japan, and appearing in their *Transactions* for 1875–76, p. 39:

"For preparing the mould, which consists of halves, put together with their concave surfaces, the workman first powders a kind of rough plastic clay, and mixes this with levigated powder of a blackish 'tuff-stone' and a little charcoal powder and water, till the paste is plastic and suitable for being moulded. It is then roughly formed by the aid of a wooden frame into square or round cakes; the surface of the latter is covered with a levigated half-liquid mixture of powdered '*chamotte*' (old crucibles which have served for melting bronze or copper) and water. Thus well prepared, the blackish paste in the frame receives the concave designs by the aid of woodcuts, cut in relief. The two halves of the mould are put together in the frame and dried. Several of these flat moulds are then packed in a melting box made of clay and 'chamotte.' This box has on the top an opening, into which the liquid bronze is poured, after it has been melted in small fire-proof clay crucibles. The liquid metal naturally fills all openings inside the box, and consequently also the cavities of the moulds. For mirrors of first quality the following metal mixture is used in one of the largest mirror foundries in Kiôto:

Lead	5	parts.
Tin	15	"
Copper	80	"
	100	

For mirrors of inferior quality is taken:

Lead	10	parts.
Natural sulphide of lead and antimony	10	"
Copper	80	"
	100	

* * * * * * *

"After being cooled the melting box and moulds are crushed and the mirrors taken away. These are then cut, scoured, and filed until the mirror is roughly finished. They are then first polished with a polishing powder called *to-no-ki*, which consists of the levigated powder of a soft kind of whetstone (*to-ishi*) found in Yomato and many other places. Secondly, the mirrors are polished with a piece of charcoal and water, the charcoal of the wood *ho-no-ki* (*Magnolia hypoleuca*) being preferred as the best for this purpose. When the surface of the mirror is well polished it is covered with a layer of mercury amalgam, consisting of quicksilver, tin, and a little lead. The amalgam is rubbed vigorously with a piece of soft leather, which manipulation must be continued for a long time until the excess of mercury is expelled and the mirror has got a fine, bright, reflecting surface."

R. W. Atkinson.

University of Tokio, Japan.

ORNAMENTAL CHAIRS. DESIGNED BY BERNH. LUDWIG, VIENNA.—(*From the Workshop.*)

Paper from Cactus.—The *Greeley Tribune* tells us that the manufacture of paper of excellent quality from the species of Cactus growing in great abundance in the Mojava Desert, has recently been tested at the Lick paper mill, at San José, by parties interested, who propose, if possible, to obtain control of all the paper mills on the coast, and set them in operation on this material exclusively. The Cactus paper is said to be very strong, and the supply of material unlimited.

HOW TO MAKE RUBBER HAND STAMPS.

D. says: In answer to several correspondents who wish to know how to make rubber hand stamps: Vulcanized rubber is used, as prepared, by the manufacturers, and can be procured in strips about 3 inches wide and about $\frac{1}{8}$ of an inch thick and of any desired length. The name and address should be set up in common printing type and the type well oiled: a rim about $\frac{1}{4}$ inch in hight should be placed around the form, and dentist's plaster, mixed to the proper consistence, poured in and allowed to set; then the plaster cast is separated from the type. A piece of the soft vulcanized rubber is then cut of the size of the plaster mold, and laid upon it, and both together are placed in a screw press, and heat sufficient to thoroughly soften the rubber is applied. The screw is then turned down hard and left for a short time until the rubber is perfectly forced into the mold.

After the whole is cold, the rubber is separated from the model, and any irregularities trimmed off with a sharp knife; the rubber stereotype is then fastened, with glue or other cement, to a block of wood, and the stamp is ready for use.

To Oxydize Gold, Silver, or Brass.—Paint over the parts to be oxydized with a solution of chloride of platinum, then let it dry. To make the chloride of platinum in solution dissolve one drachm in two ounces of hot water.

An alloy of 100 parts of aluminium and 5 of silver can be worked like pure aluminium, but is harder and susceptible of a beautiful polish. An alloy of 100 parts of silver and 6 of aluminium is nearly as hard as ordinary silver, but has the advantage over it of containing no metal of a poisonous nature or which can effect a discoloration of the silver.

In the disputed fire case of the Aldine company of New York, disappearance of electrotype plates was accounted for by a remarkable illustration of the fusibility of the type metal. According to the report, a fine powder rejected by insurance men as ashes, was 35 per cent. lead. The antimony of the alloy possibly passed off in fumes of antimonic oxide.

THE ART OF PRINTING.

The four hundredth anniversary of the early printer's invention was celebrated with more enthusiasm at Montreal this year than at any other place on the continent. Addresses were delivered June 27th by Principal Dawson, Hon. Mr. Chameau, and Mr. T. White, Jr. A large collection of old and rare books and prints and coins had been made in Mechanics' Hall, comprising quite a museum of antiquities. There was a large folio copy of the Decretum Gratiani, printed in Strasbourg by Henry Eggestein, an apprentice of Guttenberg, in 1472; a copy of Caxton's Dictes and Sayings of the Philosophers, 1477; and one of his Polychronian, 1482; a copy of Tulley's Offices, printed by Wynkyn de Worde in 1534. Other curiosities were Law Statutes of Henry VII, printed by Richard Pynson, 1510, Vitas Patrum, Wynkyn de Worde, 1495, and Grammatical Primæ Partes, same printer, 1533. There were also 533 specimens of the art previous to 1650, and 480 subsequent to that date. The Mazarin Bible, printed in 1455 by Guttenberg himself, a book printed by Faust in 1459, and a copy of Eliot's Indian Bible, attracted great attention for their rarity and antiquity.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(1) J. W. asks: 1. Will a brass pipe expand in length as a pressure of steam is gradually let into it? A. Yes. 2. How much in length will a brass pipe 4 feet long by 1 inch inside diameter expand as steam pressure in it rises from 0 to 30 pounds, also 60 pounds? A. 0·1 inch and 0·114 inch respectively. 3. Is there any metal, as a rod ¼ inch diameter, which, if placed within the pipe, will contract or remain stationary, or nearly so, as the pressure rises? A. None. 4. Will a large brass pipe expand more or less than a small one? A. The same.

(2) H. C. M. asks: What will harden soft spots in a grindstone and leave it so it will wear away evenly? A. We know of nothing that will penetrate and harden the spots.

(3) F. A. W. says: I have made a Voss-Holtz electrical machine with a revolving plate 8 inches in diameter. It will when in good working order give a 2 inch spark, but is constantly changing or rather reversing its poles. I had the same experience with a simple Holtz and also with a Wimshurst machine. Kindly give reason and remedy through your paper. A. Sometimes this happens owing to a slight displacement of the armature or stationary plate. See that it is free from liability to move.

(4) J. P. A.—The extreme depth of water in the Mersey River over the tunnel is, at high tide, 90 feet. The average thickness of solid rock between the bed of the river and crown of the tunnel is 30 feet, and nowhere less than 25. The height of the tunnel is 21 feet. The Nicaragua Canal would pass through a much healthier climate than the Panama Canal; the obstacles would not be so stupendous; the line to be cut would be less, as Lake Nicaragua would be utilized; it would present a shorter line from the North Atlantic to the North Pacific; but it would have to employ locks. The cost would be less both in men and money.

(5) "Inquirer" asks the method of finding the height of a conical frustum containing 20 pounds of lead, the diameters of its faces being 3 inches and 1¾ inches respectively. A. The volume of 20 pounds of lead must first be found. The specific gravity of the metal being 11·363, and the weight of a cubic foot of distilled water at 0° C. being 62·418 pounds, it is a simple calculation to find the number of cubic inches of lead which will weigh the required number of pounds. This must then be put equal to the volume of a conical frustum which is given by the following formula:

$$v = \tfrac{1}{3} h \left(a^1 + \sqrt{a^1 a^2} + a^2\right)$$

in which a^1 and a^2 are the respective bases and h the height. The area of a circle being πr^2, we have all the data in the above equation except h. But we have found the value of v by the previous calculation. The equation may therefore be solved for h, giving us the result desired. Or, the formula may be stated as follows, omitting the separate calculation of the areas of the two circles:

$$v = \tfrac{1}{3} \pi h \left(r^2 + r\mathrm{R} + \mathrm{R}^2\right)$$

in which $r = 1\tfrac{1}{2}$ inches and $\mathrm{R} = \tfrac{7}{8}$ inches.

(6) R. M. C. asks for details of a 14 inch hollow wall, designed to keep out the damp. A. Such a wall is formed of two casings with a space 2 inches wide between them, the outside casing being one brick, or 8 inches, in thickness and the inside casing half brick, or 4 inches. The bricks of each casing are laid in the ordinary manner, either in the usual running bond or, if it is preferred, in Flemish bond. The two casings are connected together by the insertion of galvanized iron or other ties in every fourth course in height and at distances apart of about 30 inches. Ties are manufactured for the purpose in various designs. The base of the wall is built solid up from the footings to just above the ground line, where it is covered on top with a damp course of asphalt or some other suitable material, impervious to moisture. The casings are then built upon the asphalt with the two inch space between them, forming a gutter to receive and carry away any water that may get in. This gutter is constructed with a slight fall and is connected with the drains. Care must be taken to place over every window and door frame a strip of sheet lead or zinc of a width a little greater than that of the frame, so that any water which may fall upon it shall drip off into the gutter below. A house built with hollow walls, properly constructed of good materials, will be perfectly dry.

(7) G. W. asks what it is that is put on paper, so, when you breathe on it, it will in a few seconds blaze up in a flame. A. Perhaps it may be phosphorus. Whatever it may be, our advice is to leave it alone. It cannot be a desirable article to have around.

(8) E. C. M. says: In your issue of March 6, query No. 32, W. T. W. A. asks for a remedy for ingrown nails. An excellent one, affording almost immediate relief, is the following, viz.: With a piece of glass or a file scrape along the top of the nail until it is very thin in a line with the toe; then, if the nail be too long, cut away some of the middle part of the edge only. By these means the nail is rendered elastic and yielding, and the corners are relieved from the pressure that caused the pain and inflammation.

(9) A. B. asks what to wash lamp chimneys in so they will not crack. A. Place the chimneys in cold water, and then gradually heat until the boiling point is reached, then allow them to cool slowly. By repeating this operation several times, the glass will become thoroughly annealed, and no fear of cracking need be had.

(10) G. S. asks: 1. What will stick sheet lead to cardboard? A. See list of "Cements" given in SCIENTIFIC AMERICAN SUPPLEMENT, No. 158. 2. Is there any way to cure dreaming? A. Do not lie on your back, and be careful to keep your stomach in good condition. Children sometimes have articles tied to them, so they will not turn over on their backs while asleep, as a preventive of disturbing dreams. 3. In what proportions is tincture of cantharides used for the hair, and how is it to be applied? A. Scald black tea, 2 ounces, with 1 gallon of boiling water, strain, and add 3 ounces glycerine, tincture of cantharides ½ ounce, bay rum 1 quart. Mix well, and perfume. Apply by rubbing on the head.

(11) W. W. N. asks for the component parts of Leclanche battery porous cup and prism. A. Manganese dioxide and carbon (graphite or powdered coke) with dust sifted out, are used about half and half for porous cup. For prisms, a paste of 40 parts manganese dioxide, 52 of carbon, 5 of gum lac, and 3 of bisulphate of potash, is compressed by a pressure of 300 atmospheres, at 100° C.

(12) J. H.—Alum gives excellent results when it has been found desirable to clarify muddy or turbid waters. Ammonia water will precipitate all iron in solution, but is not likely to be as successful a clarifying agent.

(13) L. D. P. asks what to add to nickel solution of double sulphate and ammonia to throw down any copper or iron that may be in it. Also, what will throw down the nickel itself? A. If the solution is acid, any copper present will be precipitated by hydrogen sulphide. Ammonia sulphide will precipitate nickel. See any work on qualitative analysis.

(14) J. L. D. asks: What will take the place of common reddish shellac, that is, colorless or nearly so? The coating desired should be waterproof, and not dissolve at a test of 110° Fah. Should be tasteless. A. Try gum sandarac 1 pound, clear turpentine 6 ounces, rectified spirit (65 over proof) 3 pints; dissolve. India rubber cut in fine shreds and dissolved in carbon disulphide or chloroform forms an excellent waterproof varnish.

(15) N. L. S. writes: How do minstrels use cork to blacken their faces and hands, and what makes it shine?

A. Take best lampblack.................. 1 grain.
Cacao butter.......................... 6 grains.
Oil of neroli............................ 5 drops.

Melt the cacao butter, add the lampblack, and while cooling make an intimate mixture, adding the perfume toward the last.

(16) F. B. writes: In refinishing furniture, I know of no way to remove ink stains. Can you give me a simple method? A. Mix 6 ounces of spirit of salt and ½ ounce of powdered salt of lemons. Drop a little of this mixture on the stains, and rub well with a cork until they disappear, then wash off with cold water.

(17) Information desires the composition used for making silicate slates. A. We should think they could be made with pulverized slate or quartz moistened to the consistency of a thick fluid with water glass, and colored with powdered charcoal or boneblack. Then apply with a brush like a paint to the required surface.

(18) A. L. Z. asks: What is the best method of collecting very fine, flat, scaly gold from an auriferous sandbank? A. Wash it through sluice ways or troughs over mercury, and then distill the mercury, leaving the gold behind. Simple pan washing will answer if the gold is in small quantities.

(19) W. H. T.—The removal of superfluous hair from skin is possible both by means of depilatories and by electricity. The former are mostly preparations of sulphide of barium or sulphide of calcium, and the process by electricity is very slow, each hair root having to be killed separately.

(20) J. F. writes: I have in use porcelain enameled jacket kettles for melting beeswax from which the enamel has come off partly; how can I repair the kettles? A. It is not likely that the defective portions can be repaired. The enameling is baked on the iron, and so when broken cannot well be replaced unless the entire enamel is removed.

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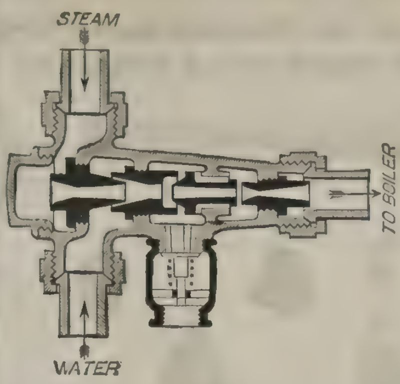

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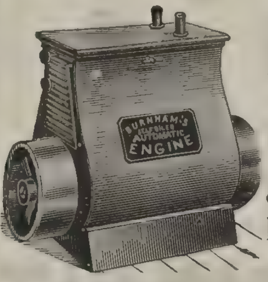

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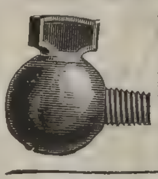

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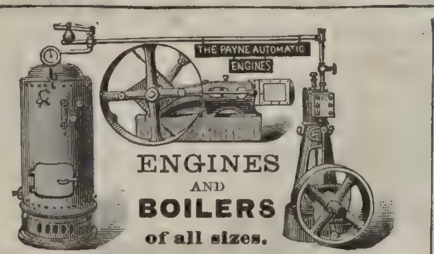

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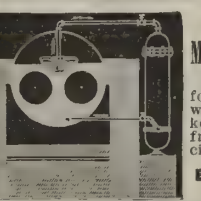

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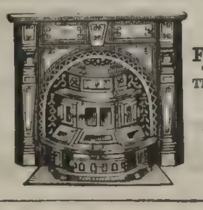

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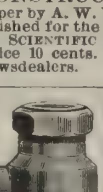

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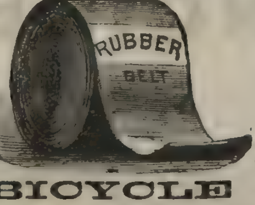

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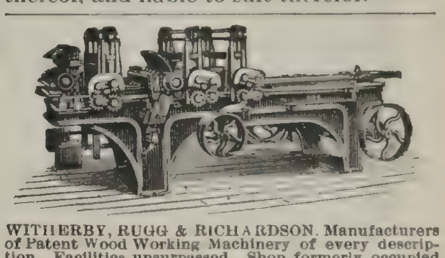

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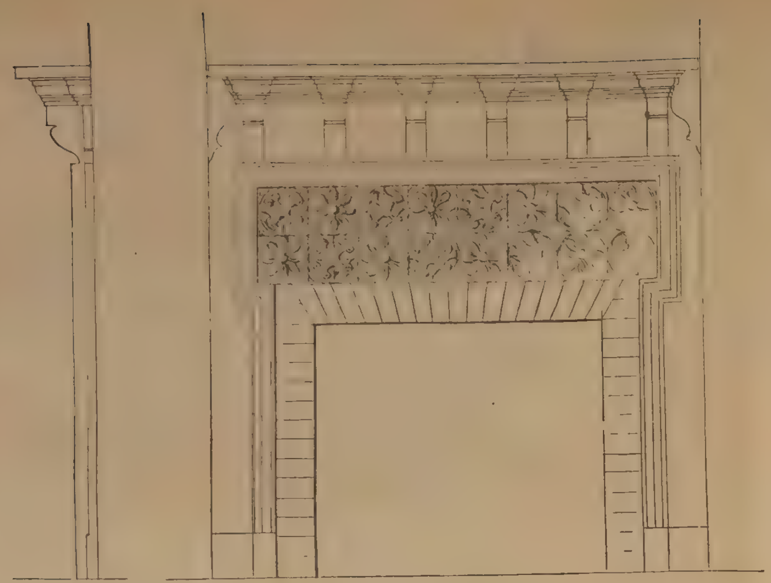
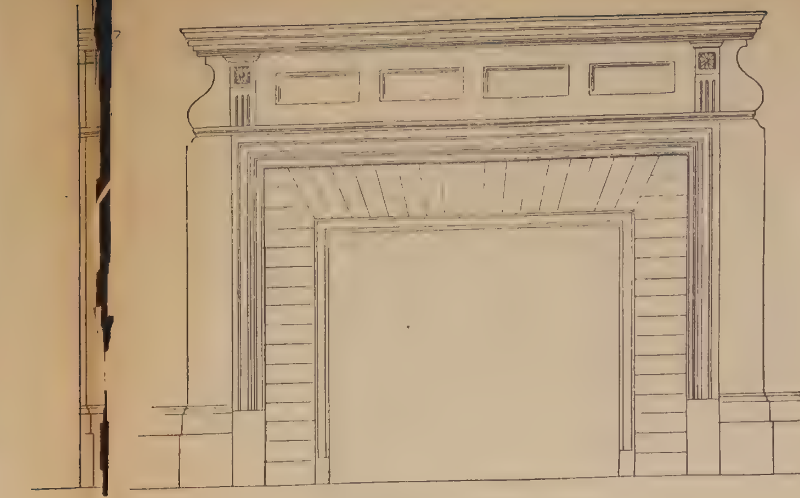
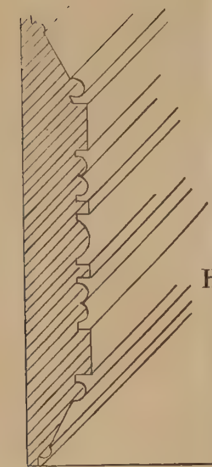


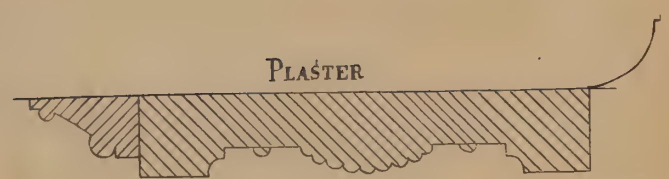
Parlor Mantel



Dining-Room Mantel



Chair Rail in Hall and Dining Room



1st Story Trim

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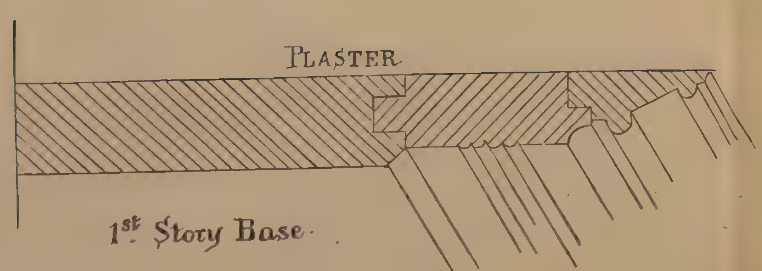
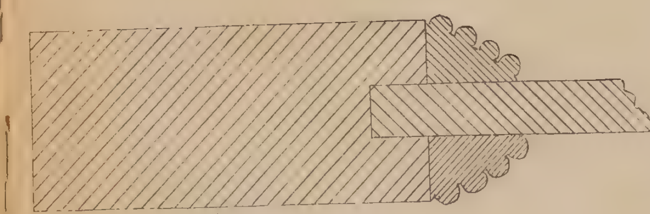


1st Story Base

Section through Hall showing Stairs and Screen



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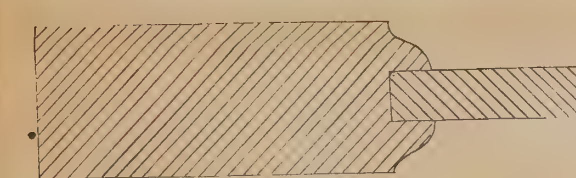
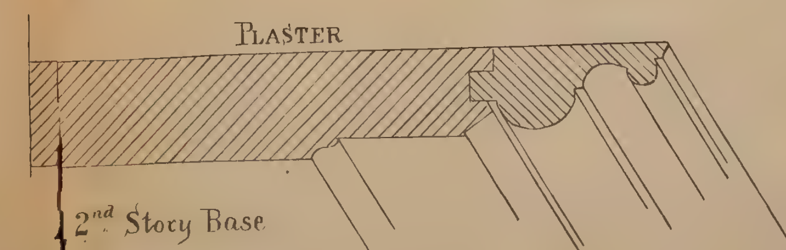


2nd Story Doors



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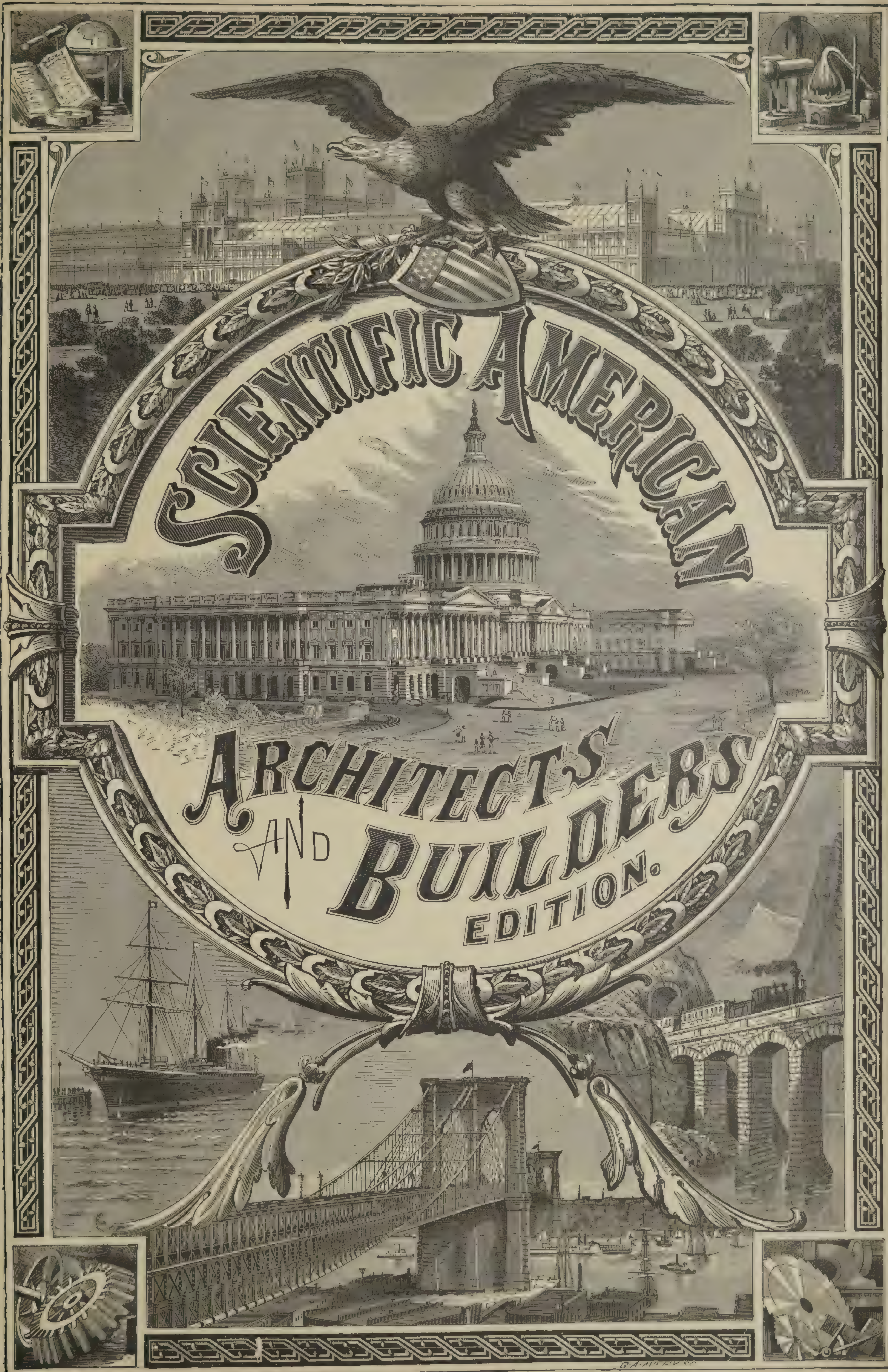

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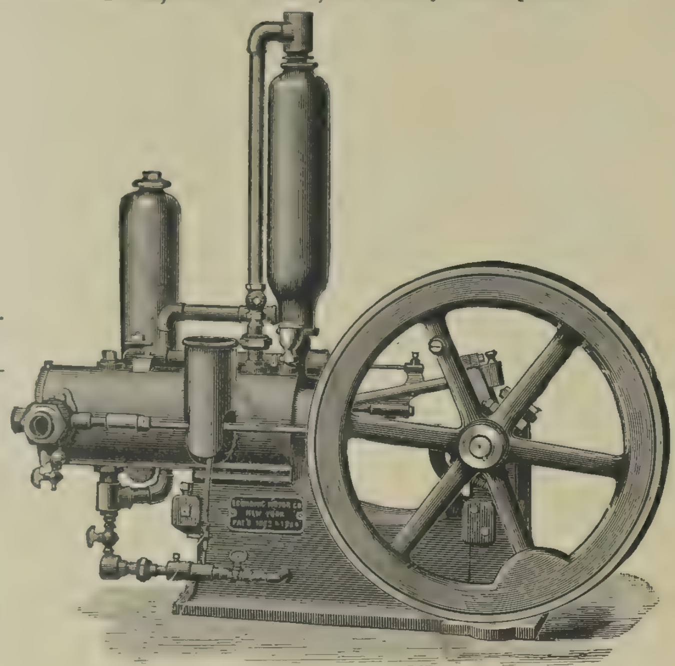

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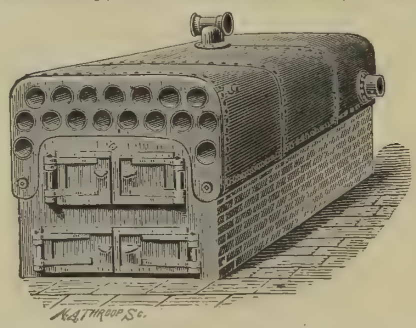

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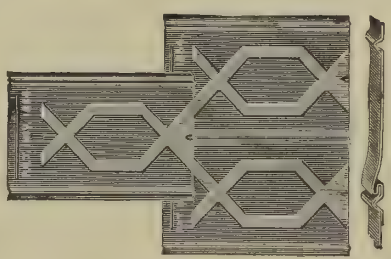

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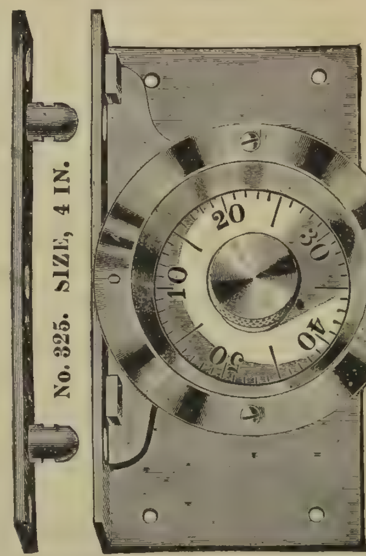

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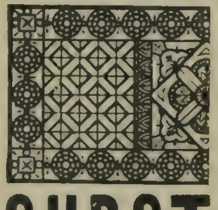

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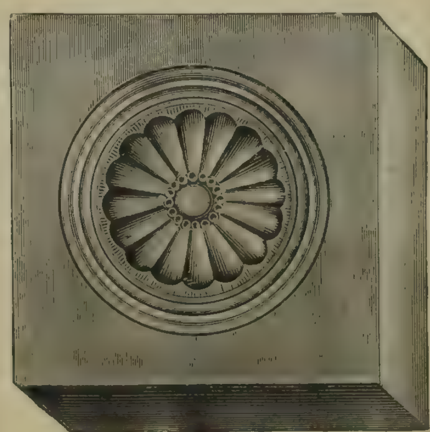


Square Turned Work.

Hard Wood Doors, Mantels and Cabinet Finish of all Kinds.

SCIENTIFIC AMERICAN

Entered at the Post Office of New York as Second Class Matter.

ARCHITECTS AND BUILDERS EDITION.

Vol. I. Subscription, $1.50 a Year. NEW YORK, JUNE, 1886. Single Copies, 15 Cents. No. 8.

Opening of the Colonial and Indian Exhibition in London.

The grand exhibition of the products of all the British colonies was formally opened by its royal patron, Queen Victoria, on the 4th of May. The scene is described as one of unusual enthusiasm. No such assemblage, it is stated, has been gathered in London since the memorable opening of the World's Fair in 1851. The fact that the Queen would go in royal state to open the exhibition had been given all possible publicity, and attracted an immense throng of spectators on the streets forming the route of the procession. The opening ceremonies were conducted in the Albert Hall, and, though simple in their character, were particularly impressive.

In the music selected for the programme, prominence was everywhere given to the prevailing idea of the exhibition, that it gathered together the representatives of British colonies in every clime to show by their products the progress attained in the general arts of civilization, and to renew their fellowship with the mother country. "Home, Sweet Home," sung by Madame Albani, and the "Hallelujah Chorus" by an immense choir of picked voices, and accompanied by grand orchestra and organ, produced a wonderful effect. But the chief feature of the opening exercises was the singing of the new British ode composed by Tennyson for the occasion. It is divided into four parts, the third section being of interest to us, as descriptive of the unfortunate policy which caused the loss of America—"that young eagle of the West"—and an appeal for wiser counsels in future. All of the parts were sung in English except the second. This had been translated into Sanskrit by Prof. Max Muller, as a mark of courtesy to the large number of Orientals attending the exhibition. After the music had ceased, the Queen symbolically declared the exhibition open by delivering the key to the Prince of Wales.

Among the more popular features of the exhibition are characteristic scenes, representing life in the different colonies and in India. One of these exhibits, known as "The Jungle," is a realistic representation of a tiger hunt. A group of four immense tigers and a hunting elephant and party make up the principal figures. These are surrounded by other specimens of the natural history of India, but in closer proximity to the contest than they would willingly be found in nature.

An Australian bush scene is another group of this kind, which shows the characteristic fauna in native setting. An Indian palace of beautiful carved woodwork attracts attention, not only from its intrinsic worth, but as well from the curious method used in its construction—It is the work of two natives, who have accomplished their task without reference to any patterns. They have originated the design as they went along, or else—and this is perhaps a more consistent explanation—they have worked entirely from memory. While the value of these displays is largely decorative, they are, nevertheless, instructive as giving truthful pictures of colonial life. The exhibition is made up of colonial courts, in which the products of each dependency are displayed in a single group. It has a special interest as representing the varied resources of a single people.

A SUBURBAN COTTAGE.

The drawing presented herewith is a study from a small suburban cottage, to cost $2,500.

In giving a brief description of it as designed, we find the floor plans to be made so as to use all room to good advantage. Front hall runs up to rafters, and arched; has balcony on side, which also answers as a passage on second story. The stairs lead from the hall, so as to enable us to get a door into dining room, so at any time sitting room can be converted into a chamber if tenant so desires. The parlor has sliding doors and fireplace, and large plate glass window with stained glass in transom above, made to swing open. Vestibule has single sliding door, so as to prevent same from interfering with stairs. Closet for coats, etc., adjoining, with stained glass window.

Front door has transom above, for ventilation and light.

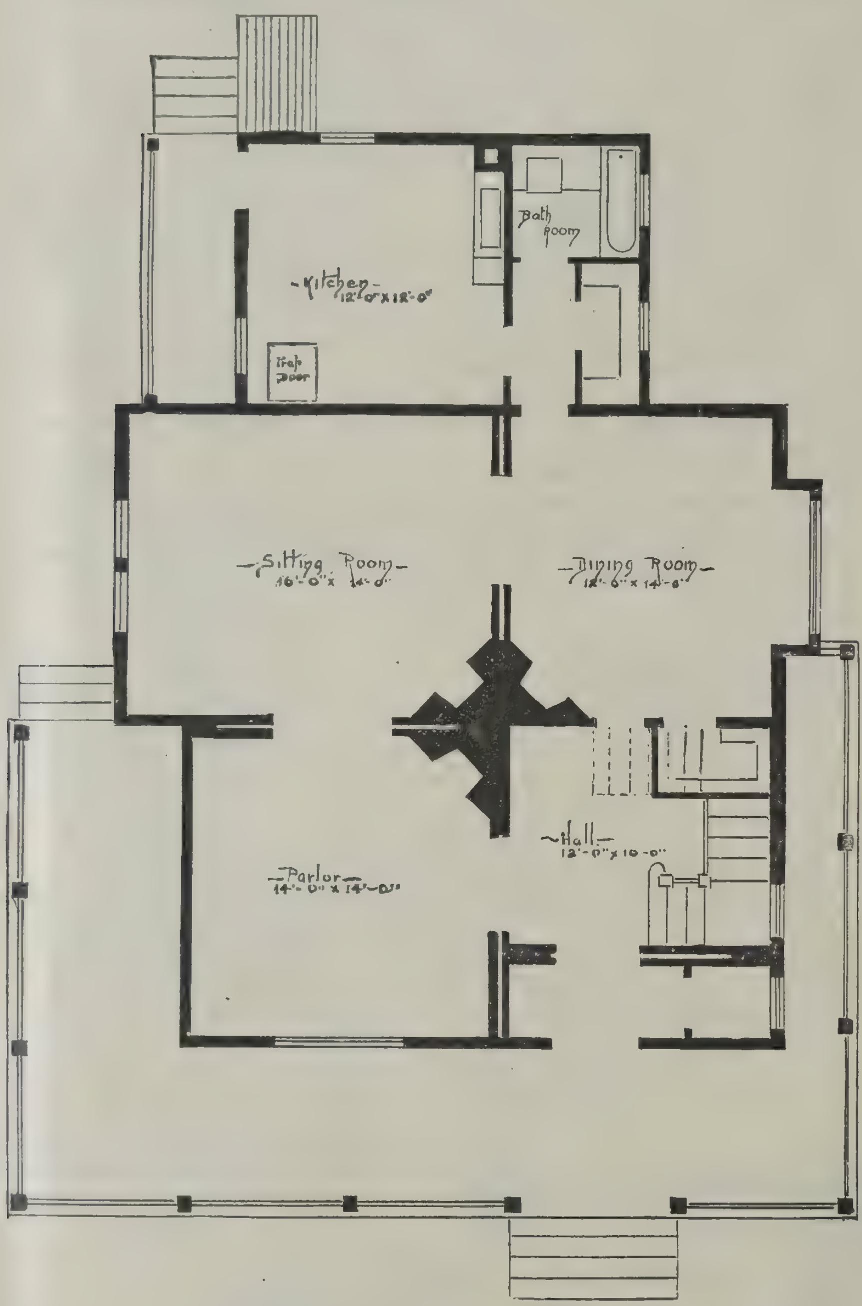
Dining room has bay window with plate glass, and stained glass transom; china closet under stairs, and passageway to kitchen, pantry, and water closet, which receives its water from a well, which is first pumped into a tank. There is a small cellar, with entrance

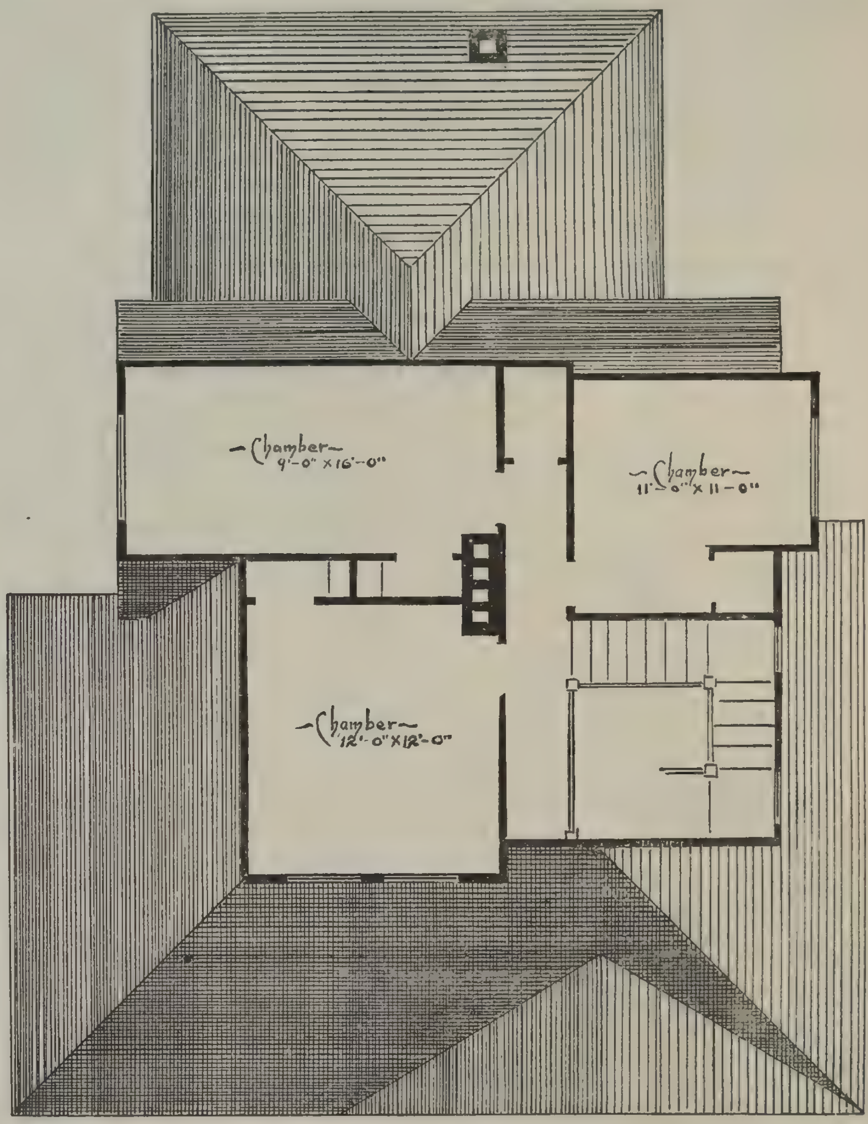
DESIGN FOR A SUBURBAN COTTAGE, TO COST $2,500—BY A H. HAAS, ARCHITECT.

from outside and trap door in kitchen. Under dining room there is a cistern.

The design is made so as to accommodate as many rooms as possible with the least number of chimneys, using only two for the whole house. The rooms throughout are of a fair size, with abundance of light and closet room. The passage in second story is wide enough to answer all purposes, with a linen closet at end.

The mantels will be rather plain; executed in cherry. All the door casings and other finish in first story will be stained cherry, except kitchen and bath room wainscoting, which will be stained oak. Dining room mantel will be designed so as to be used as a sideboard. Kitchen will have an oak floor, oiled. Second story will be painted in the following colors: olive-green casings, with old gold panels, which effective contrast forms a very pretty decoration. It will be seen by perspective that the object of design is to keep the exterior as plain as possible and still have it appear well. The gable on front porch and recessed balcony in gable on side elevation might be considered by some as unnecessary expense, yet their absence would destroy the exterior effect of the cottage. A. H. Haas, architect, Seven Corners, St. Paul, Minn.





-Second floor plan.-

DESIGN FOR A SUBURBAN COTTAGE.

The Indestructibility of Force.

Professor Attfield, F.R.S., in an address at an anniversary meeting of the Hertfordshire Natural History Society, of which he is president, happily defines the subject indicated by the title of our article as follows:

"Power, energy, or force seems to belong, if possible, to a higher order of creation than matter—matter being limited in its area and having place assigned to it, while force is all-pervading; force ever filling and ever traversing the interstellar spaces, as well as ever governing the matter which forms the moons, planets, and suns of the universe. By force is meant that which causes motion, that which actuates matter—whether the force be manifested by the muscle of an animal, the power of an engine, the stroke of the lightning; by the silent attraction of the magnet or the warmth of the sun; by the quiet but irresistible chemical power which converts one form of matter into another, or by light, to which alike the glorious rainbow and the modest violet owe their lovely hues. Force, like matter, is indestructible by any means known to us or of which we can conceive.

"To realize the indestructibility of force, let us follow in imagination the associated forces of heat and light as they, possibly with other forces, impinge on the leaves of trees in summer. The forces are absorbed, the leaves and the woody tissue with which the leaves are linked undergoing a consequent change in chemical character—in common language, the leaves and wood grow; the change and the growth being so dependent on the light and heat that neither change nor growth would take place in the absence of light and heat, even though the air and soil supplied the materials for growth as usual. Time passes, and we put the logs of those trees into a grate and ignite them. What happens? The original light and heat they absorbed from the sun, temporarily stored in their tissues as chemical force, come out of them again as light and as heat, warming and cheering us in our dwellings, and promoting our health and our comfort. The actual material of those logs, as material only, is useless to us. What is useful is the heat and the light which that material has stored up. The material itself is costly to grow, costly to hew, costly to store. We put it into our fire grates, but, as already shown, we cannot truly destroy it, we can only convert it into gas, which passes out into the atmosphere through costly chimneys. Why do we incur all this cost? To get back from that troublesome and costly material its store of invisible and imponderable, but indestructible, latent life-giving forces.

"As with wood, so with coal. Regarded as mere matter, and from the point of view of the user, the coal itself is a costly and useless nuisance from the time it enters the cellar to the time it escapes from the chimney top. But without it we cannot have its associated light and heat—those forces which it borrowed from the sun ages ago, when it was a growing forest; forces never lost, never wasted, never destroyed. The matter of our fuel is indestructible, the power or energy or force carried within that fuel or food is indestructible also. We can change the form of a force, but we cannot destroy it. Thus we can put the fuel with its contained force under a boiler of water, and, igniting the fuel, can provide for the escape of the material of the fuel by a chimney, while we transfer to the water the force which the fuel carried, making the water boil, that is, making the particles of the water fly asunder with almost irresistible motion, and produce steam. The force of heat having thus been converted into motion, we, throwing aside the steam itself by any convenient means, communicate its motion to pistons, cranks, and wheels, and so get various effects useful to man. Possibly, by the aid of wheels and bands, we change this force of motion into the force of magnetism or into the force of electricity. The latter we can pass along a wire until it meets with an obstructing wire, when immediately it is changed into the force of light, and we get the so-called incandescent electric light. Or we may convey the electric force into water, a separation of whose elements resulting gives us an opportunity, through the silent agency of the chemical force, of getting heat from the oxyhydrogen jet, and a conversion of that heat into light if we place anything which can be made white hot within the jet.

"Here, then, is a whole series of transformations of force. First, noticing it as light and heat, we find it changed into chemical force, back into heat, this into motion, motion into magnetism, the magnetism into electricity, this into light, or into motion, or into chemical force, this into heat, the heat once more being converted into light. Transformation, always; apparent dissipation, rarely; destruction, never!"

An Improved Sash Frame Pulley.

Palmer's "Common Sense" sash frame pulley, although it has been on the market but a few months, is said to be meeting with especial favor among leading hardware houses, both jobbers and retailers.

It makes a handsome frame; and when frames are shipped in knock-down form, the pulleys can be left out until destination is reached, so the jambs will pack closer and insure delivery in good order. It is only a moment's work to drop the pulley in place and put in the screws, no special tool or machine being required, a center-bit for hand-boring and an auger-bit for machine-boring being all the tools needed. See advertisement on another page.

School Days.

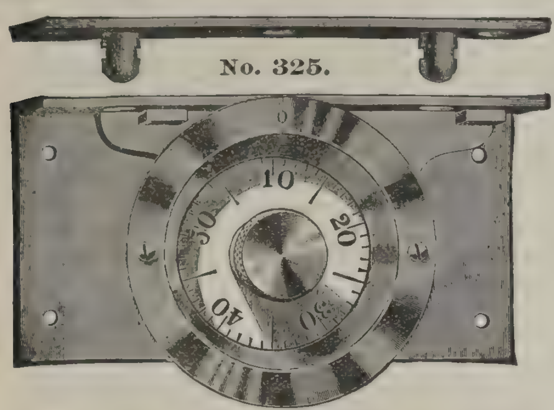
From the last report of the Commissioner of Education, it seems that of all the States from which returns were received for the year 1882–83, New Jersey showed the highest average duration of the school period, a total session of 192 days. For the same year, Tennessee had the shortest school term, 78 days. For 1883–84, the last year covered by the report, no record of this item was received from New Jersey. The highest average duration reported came from Ohio and Rhode Island, where the total term was 184 days.

Of the Territories, Arizona takes the lead, even exceeding the record of the States, as she reports 210 days as the average length of the school term.

THE "CHAMPION" KEYLESS LOCKS.

Our usual expression for security is that we have placed valuables "under lock and key;" but as the lock may be picked and the key lost, this does not always describe the best fastenings. In some of the improved "Champion" locks there is neither key nor key hole. Doors provided with them may be opened from either side, the "Open Sesame" being a knowledge of the combination of figures by which the knob may be made to turn and the door open.

Several forms of these keyless locks are manufactured, the shapes varying according to the purpose for which they are to be used. We illustrate the two forms which will be of more particular interest to builders. The first, known as the "Champion" flush dial chest lock, will be found of much value in

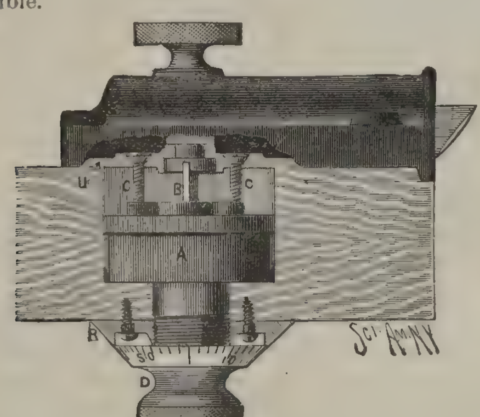


CHAMPION FLUSH DIAL CHEST LOCK. SIZE, 4 IN.

protecting a fine set of tools or other shop valuables from theft or the inconvenient curiosity of visitors or borrowing by associates.

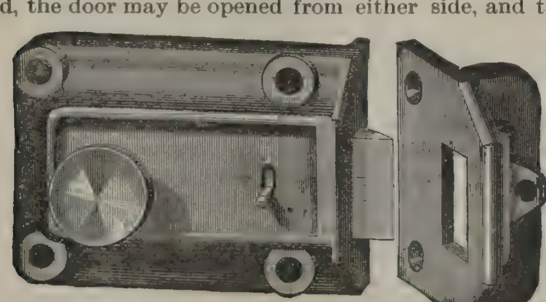
As its name implies, the lock is let in flush with the woodwork, that it may not be exposed to injury. It is made entirely of brass, with the dials nickel plated. To open a chest so fastened, it is necessary to know the three numbers which make up the combination. As the possible combinations are *almost infinite*, there is little chance of the secret being discovered. The numbers may be changed at pleasure, so that, should the combination become known to any undesirable person, it is a simple matter to change it. In construction, the lock is strong and reliable, and being so much more simple, it can be opened in much less time than an ordinary safe.

If it be feared that the combination might be forgotten, it must be remembered that a key is not only liable to be left behind, but as well to be lost or duplicated. The combination necessary for the unlocking of a keyless lock may be recorded in any number of places, and in such a way that detection would be impossible.



CROSS SECTION OF CHAMPION KEYLESS DOOR LOCK. HALF SIZE.

The "Champion" keyless Door Lock is, we believe, the first keyless dial lock applied to a wooden passage door. We show it in section, and also the outside and interior parts, which are visible when it has been applied to a door. The difficulty heretofore has been to control the fastening from both sides. As now arranged, the door may be opened from either side, and the



INSIDE LATCH OF CHAMPION DOOR LOCK. HALF SIZE.

lock may be put in place with little trouble. The section shows its construction.

The smaller part of the cylinder, A, is screwed into the ring, R, on the outer face of the door. The spindle is then put in, and the under plate, U, of the bolt case is laid against the inner face of the door. The screws, CC, secure this plate to the cylinder, A. The lock is adjustable to any door. The mechanism by which the dial piece, D, operates the bolt is connected with the bar, B. Before the case is put on, the combination is to be set, in a manner described in the directions accompanying each lock.

By means of the latch shown on the inner side of the case, the bolt may be "thrown off," as in ordinary night latches. A single revolution only is required preliminary to unlocking, and the combination is made directly by turning at once to each of the three numbers.

These latches require a pretty good light to see the dial, but there are many well lighted places where such a lock, if sold at a reasonable price, can be used with convenience and economy.

They are made by the Miller Lock Co., 817 Cherry St., Philadelphia, who will be pleased to send illustrated catalogue on application. For prices see card on second cover page of this issue.

Endolithic Marble.

Endolithic is merely an unhappy Greek combination made to describe the very interesting fact that a process has been invented whereby color can be forced into, and even made to become a permanent part of, marble. That is to say, that a block of common white marble may by this process be transformed into a Siena green, blue, black, or any other colored marble. How this is done is not disclosed except in the vague statements that mineral pigments, peculiarly treated, are used for coloring, and that the marble is then subjected to certain processes which drive the treated pigments into the marble in right lines.

It is in this peculiarity of the coloring matter to sink into the marble in lines at right angle to the plane of the surface that the value of the endolithic process mainly lies. For because of it any design, however delicate or elaborate and however varied in color or shade of color, can be painted upon the marble and then forced into it in all its integrity. In other words, a geometric design or a picture may be in this way made as imperishable as the marble itself.

The exhibit of endolithic marbles at No. 123 Fifth Avenue proves that so much, at least, can be done; for it consists of masses of marble in colors, which heretofore have been found in such small quantities as to be almost priceless, and of slabs decorated in a variety of designs ranging from dado patterns to flower and figure pieces.

The inventors claim that exposure to the elements has no effect upon the colors. The marble itself will disintegrate in precisely the same way that any marble will do, but the color will remain as long as the marble does. If this be so, the artist and the architect have in their hands a beautifying agent of rare value. Mosaics, which depend for their importance upon the costliness and rarity of the small pieces of colored marbles used in their composition, will hardly hold their value in the artistic flooring and wainscoting of the future, for by this process an equally permanent effect may be obtained without the disfigurement of the joining lines necessary in the mosaic.

For table tops, mantels, and other similar articles, the endolithic process seems to offer itself as a relief from the usually hideous white slab which throws a chill of color as well as of fact all about it. At any rate, to the furniture manufacturer, and perhaps even to the tombstone maker, there seems to have come the opportunity to indulge the present praiseworthy demand for effects in color.

It is said that by the same process bone, ivory, and such like substances can be permanently colored; although no examples of such work are exhibited. But even if the process were confined to marble, the invention of it is sufficiently remarkable, and from an art standpoint, at least, promises to be a revolutionary agent.

Doctor Hand-Smith, an American chemist resident in London, invented the process, and claims for himself the dignity even of discoverer. But though there is some talk of movement of molecules or atoms of color, there is no exposition of their action in the premises.

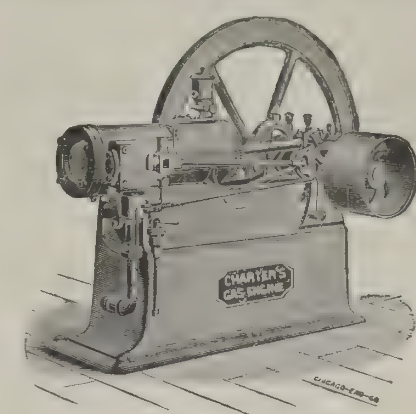
His first experiments seem to have been in the direction of converting white marble into Siena, and this, according to the statements made, he accomplished finally by impregnating and fixing permanently in the white marble precisely those salts which analysis showed to make the difference between it and Siena. In other words, he absolutely made of the white marble, not an imitation, but a genuine Siena—a Siena which the closest analysis could not distinguish from quarried Siena. After this the rest was easy, for, as he says, he had discovered the principle underlying the impregnation of marble and a large class of substances with color.

Whatever the means employed, the results are certainly both wonderful and beautiful. A slab of cold common white marble is made to glow with the richest and warmest colors. The most delicate hair line drawn on the surface is made to sink into the marble without the least loss of its individuality.

THE CHARTER'S GAS ENGINE.

The accompanying engraving shows the perfected Charter's gas engine, manufactured and sold by the Williams & Orton Manufacturing Co., whose address is P. O. Box 148, Sterling, Ill. The engine consists of a power and a supply cylinder (the latter being placed under the power cylinder), both of which are provided with suitable pistons operated by one crank, thereby making the construction very compact. The engine gives an impulse at every revolution, and being a light machine for the power given, it can be used in the upper stories of a building, as well as in the basement.

The largest engines are as simple and compact as the smallest, having only one power cylinder, and are as simple of operation as the smallest. These engines are



THE CHARTER'S GAS ENGINE.

built upon the interchangeable system, and they are so simple in construction and operation that any person of ordinary ability can put together and operate them without difficulty. In fact, the simplicity of the first-class steam engine has been equaled in this gas engine. The ignition valve is very simple, being cylindrical in form, and requires no springs or screws to keep it in position, thereby avoiding all friction; nor does it require any adjustment either before or after starting the engine. Only one light is used, and that requires no adjustment. It is most economical in the consumption of gas, requiring only about twenty cubic feet per indicated horse power per hour when doing full work; and gas is used only in proportion to the work done.

These engines are being extensively used for pumping water for hydraulic elevators, for running printing presses, freight elevators, machine shops, etc.

Further particulars can be had by addressing, as above, the Williams & Orton Manufacturing Co.

The Perception of Pale Color Tints.

Mr. E. L. Nichols has contributed to the *American Journal of Science* an account of results obtained from experiments conducted with a view to ascertain the sensitiveness of the eyes of a number of persons, comprising 31 men and 23 women, for the feeblest indications of tint in a mixture originally perfectly white. The white basis was carbonate of magnesia; and the colored powders (which included red lead, yellow chromate of lead, green chromic oxide, and ultramarine) were mixed with it in known proportions—the unit of the white base being 100 million parts. The colorations were perceived by the men when 16 parts of red lead, 17 parts of lead chromate, 818 parts of chromic oxide, and 149 parts of ultramarine had been respectively added to the 100 million parts of magnesia carbonate. The women detected the tints when 60 parts of red lead, 33 parts of lead chromate, 914 parts of chromic oxide, and 108 parts of ultramarine had been added to the unit quantity of the white base.

Thus it appears that, contrary to generally received ideas, men perceive very faint tints of color quicker than women; although it must be remembered that the number of subjects experimented upon was rather small to form the foundation of a safe generalization. The exception to this conclusion in the present case is with respect to the ultramarine. It is also worthy of remark that red lead was the most effectual coloring material for its weight, although the yellow lead salt pressed it very closely in the matter of distinctiveness. The sensitiveness of the human eye for a faint green tint is evidently much inferior to that for any other color. The author has determined upon these subjects the degree of sensitiveness to different tints of the same color.

For this experiment the subjects were given a number of tubes containing colored powder in different proportions, and requested to arrange them in order of intensity. The average percentage of correct assortments made by the men out of 100 tubes of every color were: Red, 87; yellow, 87; green, 93; blue, 78. The women made the following average percentage determinations: Red, 91; yellow, 93; green, 98; blue, 83. Thus in the gradation of tints the acuity of the women was keener than that of the men. The tints most easily recognized by both were those of the green coloration.

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THE

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ARCHITECTS AND BUILDERS EDITION.

This is a Special Trade Edition of THE SCIENTIFIC AMERICAN, issued Monthly—on the first Saturday of the month.

It goes directly *into the hands of those who have the ordering of the great bulk of Building Materials and Appliances*, namely, the Architects, Builders, Constructing Engineers, and Contractors.

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CONTENTS

Of the June number of the ARCHITECTS AND BUILDERS EDITION of SCIENTIFIC AMERICAN.

(Illustrated articles are marked with an asterisk.)

Back Numbers.

At present we are able to supply to new subscribers the back numbers of this journal from its beginning in November last. Each number is accompanied by a sheet of colored plates and a sheet of details.

A COUNTRY HOUSE AT ORANGE, N. J.

Our large colored plate for the present month of June illustrates a house recently built for Mr. Joseph Davis, at Orange, N. J., from plans and under the superintendence of Joseph A. Stark, architect, 12 Chambers St., New York.

This house is an example of a really well built small family residence for the country. It is conceived in a picturesque but chaste style of design, free from current extravagances. It has been the aim of the architect to impress upon this house a greater air of solidity and permanence than is usually reflected in our frame houses. The absence of these qualities is keenly felt by all Americans returning home from a more or less extended stay abroad, during which their eyes became accustomed to the solid brick and stone masonry of France and England.

For humble dwellings, frame work answers very well, and such houses can be made warm, healthful and comfortable; but where is the wisdom of putting expensive exterior and interior work upon mere shells, built of so perishable a material as wood? And are we to leave to coming generations no legacy of our tasteful country homes? These considerations are slowly obtaining greater weight with architects and the public, with the result of a tendency toward better materials and a more substantial looking style of design.

In the house here illustrated this desirable air of solidity has been obtained, not only by the employment of brick for the entire first and for portions of the second story, but also by a rich and heavy treatment of the wood details of piazza, gables, roof eaves, bay windows, etc.

The effect obtained is hardly rendered by the illustration, on account of its small scale, but is very prominent in the actual building, and very readily felt as the eye is passed around the neighboring houses of the usual type.

The junction of the framed work with the brick substructure has been forcibly accentuated by a shingled bevel with a terra-cotta band under.

Terra-cotta is employed at other points to enrich the brickwork, and a handsome ornamental panel is set opposite the piazza steps to the left of the entrance door.

The brick opening for the entrance door screen is of elliptical shape, and enriched with a moulded edge brick, intercut with terra-cotta quoins and a handsome keystone. The cellar walls are carried up foward of the first story brickwork, and a 5 in. beveled terra-cotta plinth is inserted, which gives a good base line to the house against the sloping ground level. The gables project well, and are finished with heavy verge boards, painted dark brown, and enriched with rosettes in lighter tints.

In regard to the plan, it was adapted to the grounds, and to the wants of the particular family, and suits admirably. The rooms are well shaped and well proportioned to each other, and a general air of light and cheerfulness pervades the house. The front hall finish and stairs are in ash, with a neat paneled wainscot along hall and stairs to second floor.

The front entrance door screen is also in ash, and with its beveled plate glass in the door and the cathedral glass in the side lights and top panels makes a very handsome feature. Cathedral glass is also used in the lower panels of the staircase windows. The hall and also the sewing room have a hard ash floor. The hall, parlor, and dining room have handsome mantels of ash, with over-mantels with beveled plate mirrors. The fireplace openings and hearths are handsomely tiled.

The general trim, except of bathroom, which is in ash, is of clear white pine, treated with a stained filler, shellac, and with a light coat of finishing varnish, and looks very well.

The central 4 ft. window of parlor bay reaches to the floor and slides up into the piazza roof, thus affording nearly 6 ft. headway for stepping out upon the piazza. The lower sash is glazed with one large sheet of glass in the center, which has a charming effect from the parlor. All bay windows are fitted with inside ash shutters. The pantry is handsomely fitted with drawers, table-top, and glass closets over. The two principal bedrooms have closets with drawers and shelves. The sewing room has a handsome movable closet, with drawers and shelves, covered with glass doors, for linen.

Constructionally, this house is built in the very best manner. The cellar walls are of hard Jersey brick, 14 in. thick, with a 2 in. air space, and rest on a deep concrete footing. The entire cellar is concreted 6 in. thick, and floated level with cement and sand. The laundry is floored over, the woodwork painted, and the walls have two coats of lime whiting. The first story walls are 12 in. thick, faced with selected Hackensack brick, laid in red mortar, with pointed joints.

The frame is of the usual construction, with diagonal sheathing and Manila building paper. The roofs and gables have shingles, dipped in dark red paint before being laid.

The entire cellar ceiling is plastered with a heavy coat of hair mortar finished with skim coat. All brick walls are furred off for lathing. The plastering of first, second, and attic story throughout is best hard finished three coat work, with handsome run cornices to principal rooms and hall.

The house is heated throughout with hot air from a Boynton's duplex, brick-set furnace, with heavy tin piping, double thick in all exposed parts and in register boxes. The registers are nickel-plated for principal rooms and front hall and white japanned for remainder.

The plumbing and sanitary arrangements are of the most perfect description, with the latest improvements. All traps and waste pipes are ventilated. An air tight leaking cesspool, 60 ft. away from the house, receives all soil and waste water. All rain water is collected into a separate leaking cistern, provided with an overflow.

The house is supplied with town water on the direct service system. All piping used is AAA lead pipe, with wiped joints. The kitchen has a Mott's sink with iron back, and is furnished with the West End range and heavy galvanized iron 40 gallon Brooklyn boiler. The pantry has a copper sink, with nickel-plated pantry cocks. A housemaid's closet is provided on the second floor for emptying slops and drawing hot and cold water for bedroom service. The bathtub is a 16 oz. tinned copper tub, of Steger's make, with nickel-plated fittings of handsome design.

The water closet apparatus is Harrison's patent Invincible washout closet of one piece of enameled earthenware with service cistern. The bathroom also has a 14 in. enameled washbowl, with moulded marble top and skirtings and nickel-plated cocks. An identical washbowl is provided in the principal bedroom.

The house is fitted throughout with electric bells and burglar alarm, also with lightning conductors.

All painted woodwork has three good coats of lead and oil paint. All tin flashings, gutter linings, and other ironwork have two good coats of Prince's metallic paint.

The rain water leaders are corrugated galvanized iron.

All the rooms of the house are furnished with gas in center or side lights.

The specifications included all work required for the complete finishing of the house, also a 4 ft. bluestone flagwalk 50 ft. long, the fencing in of lot, 70 ft. run of board walks and the leveling of the grounds. *No extra work was incurred in any trade.* The total cost of the house was $7,007.00 as follows:

Masonwork and terra-cotta	$1973.00
Carpentry and joinery, including mantels and mirrors and cathedral glass	3494 00
Painting	488.00
Plumbing, tinning, gas fitting, and heating	857.00
Electrical work	80.00
Iron backs, hearth and face tiling for 2 fireplaces, and face tiling for 3 fireplace fronts with hot air registers	115.00
Total	$7,007.00

The principal contractors were:

Mason.—Charles E. Dodd.

Carpenters.—P. B. Fairchild & Co.

Plumbers.—M. & T. Chalmers.

Painter.—David George.

All of Orange, N. J. The work was performed in the most creditable manner, and to the entire satisfaction of the owner and the architect.

Mr. Joseph A. Stark, the architect of the house illustrated in this issue, and whose office is at No. 12 Chambers Street, New York, is one of our most promising young architects. He has reached his present position by the force of his talents and energy. He followed the course of study at the Cooper Institute, and after some six years of experience in New York and Philadelphia offices, went abroad to perfect his knowledge. He studied and worked at Paris for two years, traveled considerably, and finally settled in London, where, during a period of nearly seven years, he was actively engaged in his profession on a variety of important and fine work. He returned to New York in 1884.

Mr. Stark is an expert designer of precise taste and original ideas. He has an intimate knowledge of planning and construction, and goes in for good and conscientious work.

CLOSE OF OUR FIRST VOLUME.

With the present issue, June, the first volume of the SCIENTIFIC AMERICAN, ARCHITECTS' AND BUILDERS' EDITION, is brought to a close. This volume will be a trifle thicker than its successors, for, besides the six numbers of the present half year, it also embraces our two pioneer numbers of November and December. The index for this volume will be sent out with our next number, July.

Volume I. can be had at our office, stitched in neat paper covers, for $1.25. Handsomely bound in stiff covers, $2.50. Postage or expressage additional.

We call to mind no publication in its class that presents so much valuable matter in a form so attractive as this first volume of our work.

The work may be ordered through any book store or news agency.

MUNN & CO., PUBLISHERS, 361 Broadway, New York.

DESIGN FOR A STONE COTTAGE.

We give an illustration from the *Building Budget*, showing the residence of W. S. Warfield, Esq., Quincy, Ill. Exterior of Kasota stone, with terra cotta trimmings of same tone of color. Cornices of copper. Interior finished throughout in natural woods—cherry, red oak, sycamore, red wood, and Georgia pine; steam heat. J. L. Silsbee, architect.

Healthy Cottages.

A lecture, under the auspices of the Preston Sanitary Association, was recently given in the Public Hall, Preston, by Councilor J. Harding, C.E., on the subject of "Healthy Cottages." Mr. Harding said: In Preston the death rate is too high, and the mortality from zymotic diseases is much in excess of that in any of the other large English cities and towns, and it is specially startling to notice our position relatively with other Lancashire towns also engaged in the manufacture of cotton. There can be little doubt that the high death rate is in a great measure resulting in Preston from unhealthy dwellings, coupled with defective sewerage, and insufficient ventilation connected therewith. The principal evil exists in and about the cottages of our town—the miserable, cramped, pent-up back yards—the lack of properly constructed, wide back roads in lieu of the narrow passages between each pair of cottages, and the defective construction of our pebble and bowlder paved yards, footpaths, and streets, and defective sewers. Cottages are generally built without the assistance or aid of an architect or surveyor, their function ending after preparing and depositing the required plans, according to the by-laws, which is compulsory before the erection of any building in the borough. A casual comparison will strike us that in scarcely any class of buildings erected in towns has there been less progress or improvement during, say, the last fifty years than in the design, arrangement, and construction of cottages. The walls of cottages are mostly badly constructed. Preston-made bricks generally are very porous, and especially when not burnt very hard. The following suggestions for improvement may be made: 1. That the external walls should be made and built with a 2 in. cavity, namely, two half-brick walls and a 2 in. cavity in the middle, bound together with irons, thus making an 11 in. wall. In this case care should be taken that the cavity is properly ventilated at the bottom and at the top of the walls by building in perforated bricks. 2. Increasing the thickness of the external walls from one brick to one and a half bricks. 3. The substitution of harder and less porous bricks for the outside. Much of the mortar used for cottage building is little more than rubbish. The refuse after passing through the destructor (two of which are being erected in Preston) supplies in lieu of cinders an excellent material for grinding and mixing with lime for mortar. Reports from Bradford, Blackburn, Birmingham, and other places speak of this material in the highest terms—that it assists in contributing to make mortar of the very best quality.

The cornices of cottages are generally of stone, without a drip, so that in case of a heavy shower of rain the water runs over the moulding and on the face of the brickwork. Sandstone—the stone generally used here—is porous, and it is necessary to cover the stone cornices with lead flashing. This is frequently scamped. The consequence is that it soon becomes useless, and rain water finds its way in the dwelling at the eaves—an evil very expensive to remedy. In the construction of a cornice, the stone cornice should be moulded to have a proper drip. It should be covered with lead of, certainly in cottages, not less than 4 lb. weight in a square foot, laid in short lengths, and of sufficient width to go well under the slates. Overhanging roofs are more suitable than anything for cottage building, the walls being better protected and more secure from the action of the weather.

In the slating of the cottage, care should be taken that the quality of the slate should be good. Slates, like sandstone, used for buildings should never be taken from the top rock of the quarries, always from the bottom rock. Slates should be laid overlapping each other at the least 3 in., and well plastered and pointed on the under side with good hair mortar. Upon no account should downspouts be constructed inside any building. The execution of sewering work is of the greatest importance. As to the construction of sewer pipes, they should be of the best quality of earthenware, salt glazed, and no cracked or broken pipe should be used. The pipes should be laid with a regular slope and inclination, and the joints should be made good with Portland cement; this is especially necessary where the subsoil is sand. The generally adopted system of having puddle clay joints is to be condemned. The sewers, if possible, should not be laid under cellar floors, and if this unhappily cannot be avoided, then extra means of ventilation should be provided by upcast shafts against the outside of walls, projecting above the eaves of the building. It is absolutely of the very greatest importance that all sewers, main drains, and branches should be well ventilated.

The sanitary statistics of Preston show markedly that the unhealthiest districts in the borough are those situated immediately in the vicinities of the upper portions, or higher levels, of the town. This is greatly to be accounted for by the fact that sewer gas is lighter than atmospheric air, and consequently rises to the upper portions of the drains, and, with the present negligence and lack of simple elementary sanitary knowledge, finds its way into the cottages and workshops. The construction and system of attending to the scavenging department of large towns are still an open and vexed question. We in Preston have at present the privy system, and I cannot too strongly condemn the present method of constructing the bogs and ashpits, these being sunk into the ground below the level of the yard 2 or 3 ft., built roughly in common mortar and brick, paved at the bottom, mostly with pieces of bricks, and grouted, if at all, with common lime or mortar, the whole work being slipshod and "jerry" built.

RESIDENCE FOR W. S. WARFIELD, QUINCY, ILL.—J. L. SILSBEE, ARCHITECT, CHICAGO.

In the case of water closets, those adopted inside dwellings should always be placed against an outside wall, with a window made to open. It is not sufficient to have a skylight. The soil pipe should invariably be carried outside the building. In the completion of a w. c., the seat should be hung similar to the cover; this slight alteration would enable the closet (failing other provision) to serve the double purpose of a w.c. and house sink. The question of the importance of ventilating a w c. has passed beyond the field of argument, for it is an undoubted fact that, unless the soil pipe is properly and effectually ventilated, the leaden pipe becomes honeycombed, and emits the deadly sewer gas into the dwelling. At the outside calculation (founded on experience), unventilated laden soil pipes are destroyed within a period of fifteen years from the date of first fixing.

The ground floor of an ordinary cottage, consisting of living room (being the kitchen), scullery, and pantry, is usually flagged. Care should be taken that precaution is exercised in selecting the material to be placed under the flags. If you want your cottage to be clear of cockroaches and crickets, never allow a particle of cinder to be placed under the flags—let there be only a good bed of sand 4 in. thick at least, though the thicker the better; this, and the flags properly laid, bedded and jointed in mortar, will, along with the dispensing with an ash grate under the kitchen fireplace, be an effectual remedy against household pests. I am not sure whether the lowness of the price of encaustic tiles will not before long bring them into demand as an improvement on the monotonous cold color of flags. The art of laying tiles is now well understood, and the many simple yet pleasing patterns, at reasonable prices, would lend additional ornament and comfort to our cottage houses; certainly, the mode of laying being on a bed of cement concrete would effectually remove the encouragement of household pests. Nothing looks worse than a cracked ceiling. While building, 2s. 6d. per house extra would prevent this unsightly sign of "jerry." In fact, there is no surer or more certain sign of a "jerry" plasterer than to see his ceilings cracking. The plaster work of cottages generally is of inferior quality, and the easy remedy of papering is often resorted to; it covers a multitude of shortcomings.

Cottage living and bed rooms would be much better, say, for a height of 5 ft. plastered in cement, and finished with a smooth surface, afterward either painted or colored in distemper. It would insure a great amount of cleanliness, and to some extent be a barrier to the spread of infectious diseases. In the planning of a cottage, the living room should always be protected from the street by two double doors, an inner and outer one. This is most effectually done by means of a small vestibule, as this breaks the draught. Cottage windows are usually constructed without back linings. This being so, it is almost impossible to prevent draughts from the sides of windows. There should always be back linings to case the weights; these enable the windows to be better bedded in plaster and fixed in the walls. Without efficient ventilation, it is impossible to expect health. It is essential in dwellings that every adult should have provision made so as to provide 450 to 500 cubic feet of air every twelve hours. Cottages generally fail to provide this, and it can only be done by seeing to the following: 1. That all bedrooms should have fireplaces in them. 2. Level with the ceiling a perforated grate should be fixed in the chimney flue in every room, the kitchen included. 3. Direct outside ventilation in kitchen and scullery, and ventilation in passage or over stairs landing. Draughts may be easily prevented by means of two pieces of zinc gauze, placed in such open ventilators 2 in. apart. This system will make ventilation effectual without perceptible draught.

Chinese Architecture in Chicago.

Cookingham & Clarke, architects, of Chicago, are engaged upon the plans for a rather unique structure, a Chinese dwelling. It is something entirely new, there being nothing of the kind in this country as far as known. The rooms are irregular in shape, none of them being square. Where the gables appear in the Queen Anne style, their place is taken by hip and Chinese parasols made of ornamental shingles. There is only one chimney; a huge one in the center is all that is necessary. The bath rooms and plumbing are also arranged in the center. It is to be built in Ravenswood by a prominent citizen of that suburb, and will cost about $5,000.

Prize Design for a New Facade, Cathedral of Milan.

M. Aristide de Togin having left a considerable legacy for the renovation of the facade of the Cathedral of Milan, the directors of the Cathedral, on whom the duty of carrying out his wish falls, invite competitive designs from all nations. The direction places no limit to the estimated price of the improvements, so that the architects are untrammeled in the exercise of their best art. It is desired as far as possible to preserve the architectural unity of the building, which, it will be remembered, is now five centuries old. The designs must be submitted between the first and the fifteenth of April, 1887. Fifteen prizes are offered. The first prize of 40,000 francs will be given for the best design, provided it is deemed worthy of execution. Three prizes of 5,000 francs, three of 3,000, and eight of 2,000 each, complete the list. Though American architects as a rule have had less opportunity of making a study of church architecture, we trust that many will enter the competition. The full conditions may be obtained from American academies of fine arts or from L'Amministrazione del Duomo di Milano, Milano, Italia.

PASSAIC CITY, NEW JERSEY.

The open country adjacent to the city of New York is in many respects most beautiful and attractive. This is especially the case in respect to the region situated westerly from the metropolis. Crossing the broad Hudson River on commodious boats, the passenger takes seat in the steam cars, in a few minutes traverses the Jersey meadows, and at once enters among the rolling hills and valleys pertaining to the flanks of the Shawangunk Mountains.

The scenery in all directions is interesting, and here are scattered hundreds of hamlets, villages, and rural cities, where thousands of people, doing business in the great city, have built their dwellings.

We have thought our readers might be interested in knowing something concerning the houses and their surroundings; for this purpose we have selected, as a type, the suburban town of Passaic City, N. J. The enterprise and courteousness of the Citizens' Improvement Association of Passaic City, of which Mr. A. Swan Brown is the president, has resulted in placing at our disposal, ready made, much interesting material.

The Association, with a view to make more widely known the merits and attractions of this beautiful city, have issued an elegant little book of fifty pages, containing much reliable information, with engravings. To its pages we are chiefly indebted for our illustrations and the facts we now present.

Passaic is situated at the head of tide water and navigation on the Passaic River, eleven miles northwest from New York city; is reached by the New York, Susquehanna & Western Railroad in less than forty minutes from New York city. The growth of the place has been healthy and natural; from a mere hamlet in 1867, it has grown to a municipality with a population numbering at the present time nearly 10,000. All of the conveniences of the great city are obtainable, with the comforts and attractions of the country. Good stores and markets abound, and the educational facilities and church privileges are unsurpassed.

The greater portion of the city is located upon table land. In the southern and western portion of the city the greatest altitude is attained, affording charming views of the surrounding country, from the Palisades of the Hudson on the east to the Orange and Garret Mountains on the west, while far to the north, beyond the beautiful valleys of the Passaic and of the Saddle Rivers, may be discerned the peaks of the rugged Ramapo and Haverstraw Mountains, and to the south Staten Island and the Bay of New York are in sight.

It contains the homes of many New York business men, and is not a place of summer homes, but of "all year" residents, who appreciate its advantages in all seasons of the year.

The air is pure, dry, and invigorating as compared with places nearer the coast. Reference may be had in this connection to many citizens, former residents of Brooklyn, who have experienced great relief and marked benefit from the change.

Inasmuch as the natural drainage is perfect, the neighborhood is free from all zymotic, malarial, or miasmatic influences, making Passaic a very healthy city. The extreme cleanliness of the town in all its parts is a distinctive feature which invariably elicits favorable comment on the part of visitors.

Another characteristic of the situation is the prevalence of the cool southern breeze on summer evenings, making rest and comfort possible even in the warmest weather.

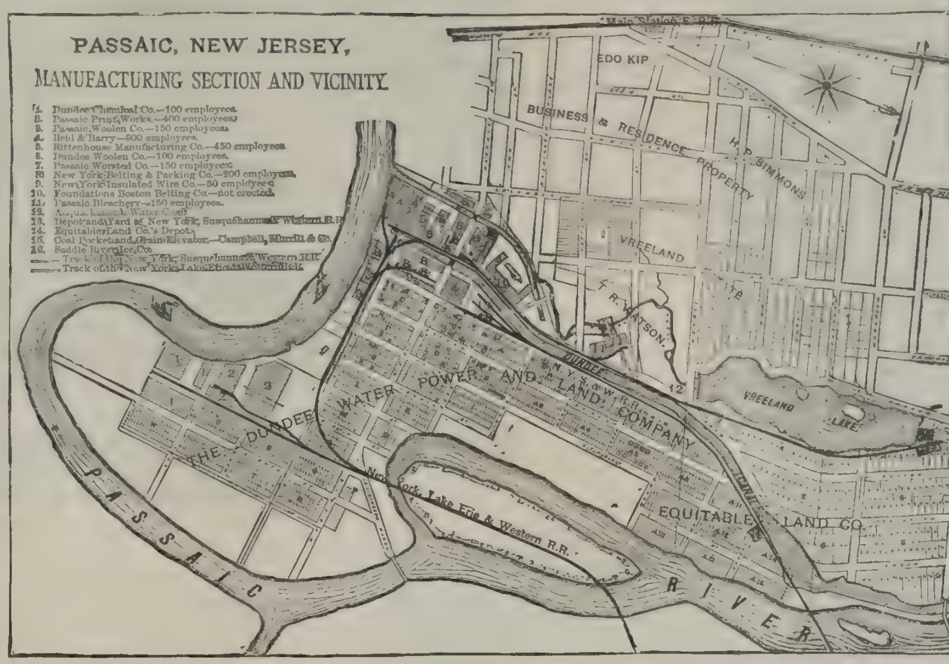
The drives and walks in the neighborhood are numerous and beautiful, the surrounding country being one of great natural beauty, and the views from the high lands are unsurpassed in the neighborhood of New York city. To the east lie Rutherford, Hackensack, Englewood, and the Palisades; to the south, Belleville and Newark; to the west, Bloomfield, the Orange Mountains, Montclair, Little Falls, and the great Notch; while to the north are Clifton, Dundee Lake, Paterson, the Passaic Falls, the Passaic Valley, the famed Paramus region, and the Saddle River Valley, all within a radius of nine miles from the center of Passaic, and objective points of charming rides. The roads are generally good.

The beauty of the Passaic River is well known; among the illustrations will be found some views, which convey, however, from their want of color, a very inadequate conception of its natural beauty and attractiveness. A few miles above Passaic City are the "Great Falls," where the river cleaves through the mountains, with a descent of nearly ninety feet, and nearer by is the beautiful Dundee Lake, and "Slauter Dam," with a fall of some eighteen feet. The river forms the eastern boundary of the city, and the lovers of rowing or sailing find ample facilities for the enjoyment of either pastime. During the season, a steamer plies between Passaic and Newark, making several trips daily, and affording opportunities for delightful excursions.

In the winter season, each snowfall affords opportunity for the enjoyment of sleighing, coasting, or tobogganing, for which latter pleasures the hillsides of the neighborhood are especially fitted.

The soil of the city and vicinage is a very fertile loam, suitable for gardening purposes and the making of lawns. It is very adaptable for flowers, fruits, and vegetables of all kinds, shrubs, deciduous and evergreen trees. It is especially favorable to the latter variety, which make rapid growth in it.

Land is held at very reasonable rates, and persons wishing to purchase will find desirable property in either section of the city. To persons of small means, desirous of escaping the rents of the larger cities and of owning their own homes, special facilities are offered by several citizens who build to suit the views of the applicant, and arrange for payment in installments.



The city has an abundant provision of water for all purposes, the supply being taken from Dundee Lake, a beautiful sheet of water, only two miles distant from the city, and one of the attractions of the neighborhood. The mains of the Acquackanonk Water Company are laid in nearly all the streets, and running water may be had even in the highest portions of the city.

In addition to four ward public school buildings, accommodating 800 pupils, a central school building, capable of accommodating 600 pupils, is in progress.

All necessary books and appliances are furnished at the public cost. Hence the trouble and expense incident to change of place is avoided.

In addition to the public schools, there are several private and parochial schools, all of the best character.

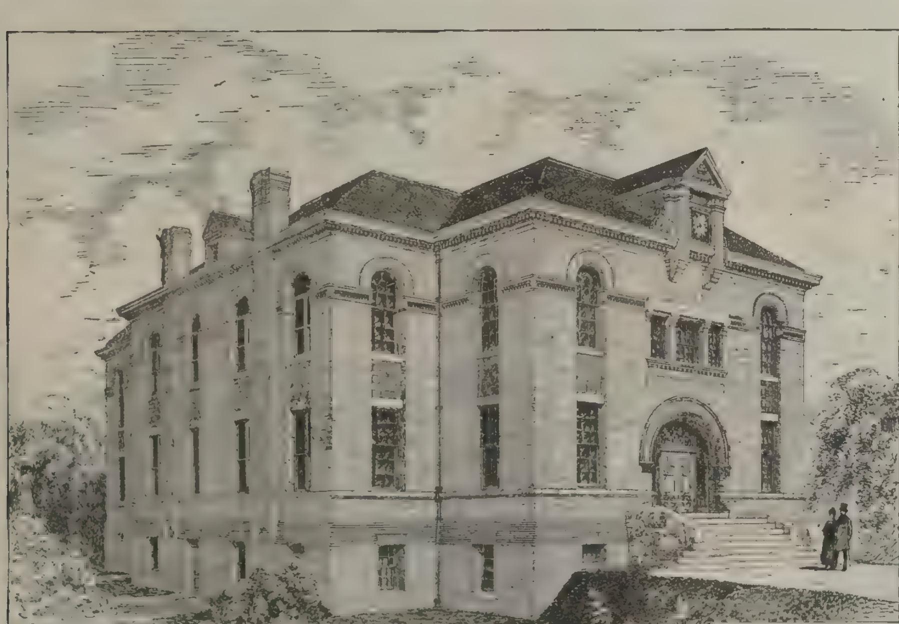
Passaic City, especially that part situated on and adjacent to the canal of the Dundee Water Power and Land Company and the Passaic River, is especially attractive for manufacturers.

Its contiguity to New York city, Newark, and Paterson, and the low rates of railroad fare, make it a part of the great labor market formed by the three cities named, in which a surplus exists at all times.

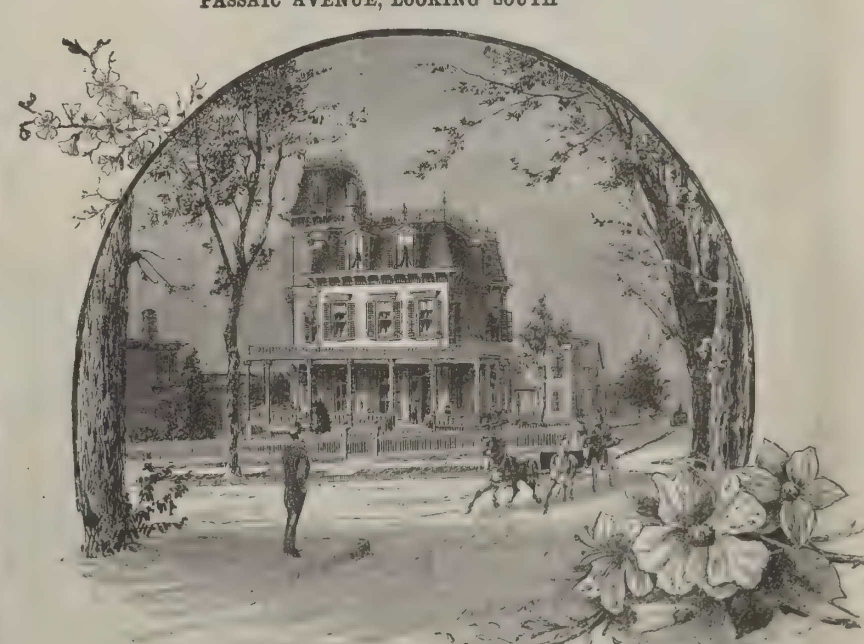
Within three-quarters of an hour from New York, and with telephonic communication, its location is an exceedingly happy one for the shipment and distribution of goods. A great proportion of manufactured goods, except for large Western houses, goes to New York; and in Passaic every advantage to be derived from an immediate delivery of goods is obtainable without expensive storage in the city. New York is also a great center for raw material, and proximity to it is an advantage also in that respect. Goods for the West are shipped from Passaic by the Erie and Delaware, Lackawanna & Western railroads direct, and by the Pennsylvania and West Shore *via* the New York, Susquehanna & Western Railroad, at the through rates prevailing in New York city in all cases. This is an especial advantage, as the large Western houses enjoy rebates and extra low rates on New York shipments, due to the competition of the many roads that center in the metropolis. Passaic is only a few miles above Newark, on the Passaic River, and accessible by steamboats and sailing vessels. In fact, lumber, bricks, cement, coal, machinery, crude chemicals, and other bulky materials are now received by the river.

RESIDENCE OF EDO KIP ESQ., ON DUNDEE DRIVE.

PASSAIC AVENUE, LOOKING SOUTH



NEW HIGH SCHOOL BUILDING, LAFAYETTE AVE.



RESIDENCE OF JOHN J. BOWES, ESQ., PENNINGTON AND GREGORY AVES.

An important requisite is the permanent supply of a pure and soft water. The water furnished by the Dundee Water Power and Land Company, which they obtain by damming the Passaic River, of which stream the minimum flow is not less than 200,000,000 gallons per diem, is both permanent and soft, coming from a red sandstone formation. It is used in Paterson for making paper, for dyeing silk in all its delicacy of shade and nicety of color, for the manufacture of chemicals; and in Passaic for all the purposes of a cotton printing business, for the manufacture of rubber, compounding of chemicals, the manufacture and dyeing of woolen cloth, and last, but not least, the bleaching of cotton fabrics of all kinds. The water is furnished to mills with a twenty-three foot head and fall, at a cost of $700 per annum for 3,000,000 gallons per day, or for smaller quantities in proportion; this price also includes the mill site. The water, when used for motor power, costs $35 per annum per horse-power.

When steam is used, the cost of course depends on the price of coal, and there is no place outside the coal regions where coal can be purchased as cheaply. It can be bought, delivered at the mills, at the regular prices charged at the dumps at Jersey City. The difference in price in Passaic and New York city and the Eastern States during the past season has been from fifty cents to two dollars per ton in favor of Passaic.

One of our illustrations is a view of the "Van Wagoner homestead," the oldest house in Passaic or neighborhood, the erection of which was commenced before the Revolutionary War, but not completed until A.D. 1778. The old house is in an excellent state of preservation, and stands as built, without any architectural alteration, and in repainting the woodwork the present owner has retained the original colors. It was the homestead of Harmonus Van Wagoner, whose name will be found in all the title searches relating to property in the hill section of Passaic, which is built on a portion of the Van Wagoner farm, a princely estate in the "Olden Time," extending, as it did, from the banks of the Passaic River to the Garret Mountain, and covering many hundreds of acres.

The rising ground to the rear of the old homestead is known as "Toney's Nose," deriving its name from Sir Anthony Howe, who was in command of a detachment of the British army which encamped upon the heights, acting as an "army of observation," with the view of intercepting the Continental army under Washington in its retreat from the Hudson River to the neighborhood of Morristown. History records,

RESIDENCE OF B. F. POPPLE, ESQ., PARK PLACE AND PROSPECT ST.

GROVE TERRACE, BETWEEN PASSAIC AND BLOOMFIELD AVES.

RESIDENCE OF DR. E. W. VONDERSMITH, RIVER ROAD.

A "QUIET HOME" ON PAULISON AVE.

RESIDENCE OF E. N. FRISBIE, ESQ., PASSAIC AVE.

RESIDENCE OF A. SWAN BROWN, ESQ., PENNINGTON AND PAULISON AVES.

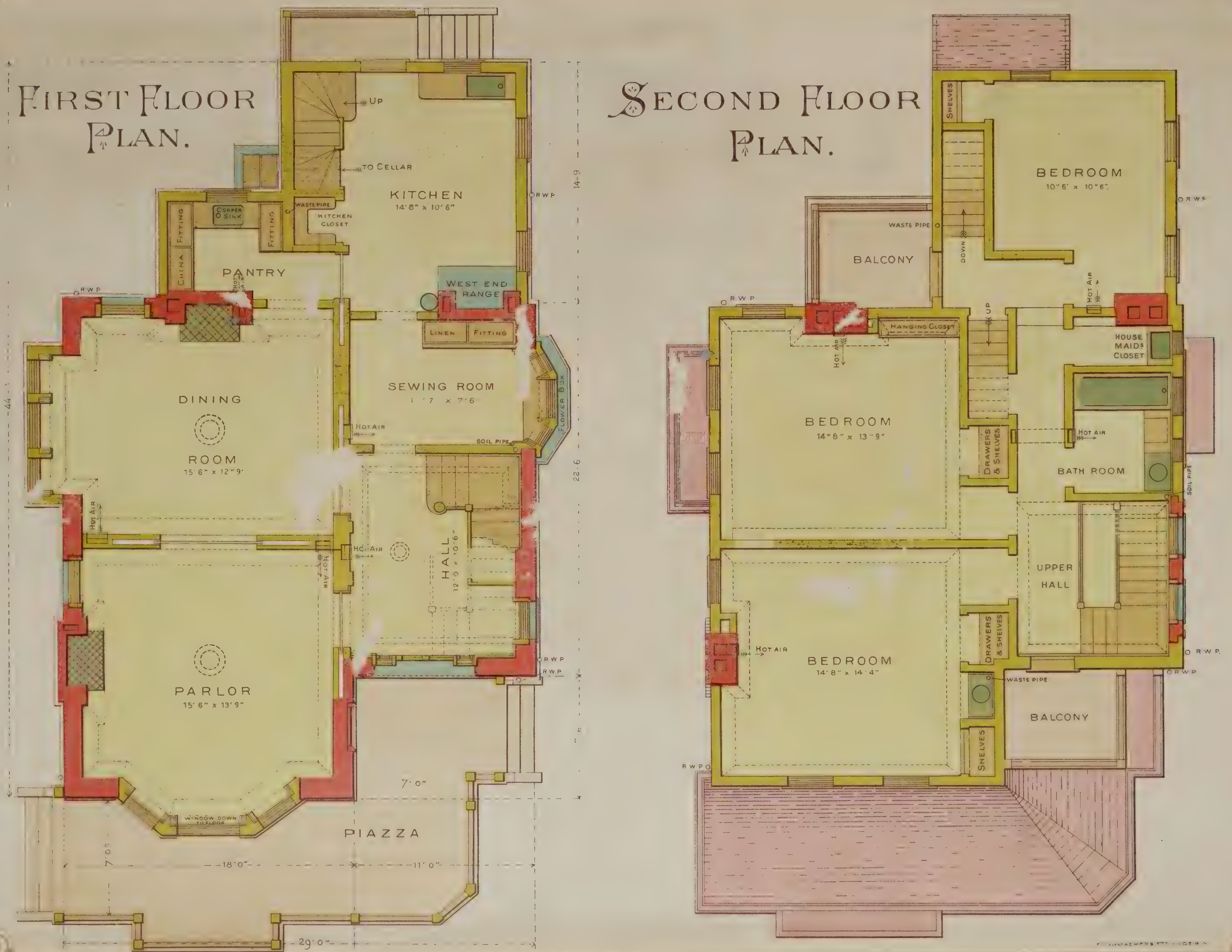
RESIDENCE OF M. E. WORTHEN, ESQ., PASSAIC AVE.

THE "VAN WAGONER MANSION," A.D. 1778.

Supplement to the Scientific American-Architects and Builders Edition-June 1886.

A House at Orange, N.J.

Joseph A. Stark, Architect, New York


FIRST FLOOR PLAN.
SECOND FLOOR PLAN.
KITCHEN
14' 8" x 10' 6"
UP
TO CELLAR
WASTE PIPE
KITCHEN CLOSET
COPPER SINK
FITTING
CHINA
PANTRY
WEST END RANGE
LINEN
SEWING ROOM
DINING ROOM
15' 6" x 12' 9"
HOT AIR
SOIL PIPE
FLOWER BOX
HALL
12' 9" x 10' 6"
PARLOR
15' 6" x 13' 9"
WINDOW DOWN TO FLOOR
PIAZZA
7' 0"
18' 0"
11' 0"
29' 0"
44
14-9
22-6
R W P
BEDROOM
10' 6" x 10' 6"
SHELVES
DOWN
BALCONY
HANGING CLOSET
HOUSE MAIDS CLOSET
BEDROOM
14' 8" x 13' 9"
DRAWERS & SHELVES
BATH ROOM
UPPER HALL
BEDROOM
14' 8" x 14' 4"
R W P

however, that Washington's forces crossed the river further to the north, and thus avoided meeting Sir Anthony and his troops at Acquackanonk, by which name Passaic was then known. The neighborhood is rich in historical reminiscences. The neighborhood of the old "Van Wagoner Mansion" in the beginning of the present century was a bustling and thriving place, the landing opposite it being the headquarters of a great trade with the West Indies in hoops, staves, shooks, lumber, and other products of the neighboring country. A large fleet of vessels was engaged in the traffic, the river affording at that date the only means of transportation to New York. Going back to an earlier date, it is worthy of note that this point was the rendezvous of all the neighboring tribes of Indians on their expeditions down the river. The old Indian trail on the west side of the river, leading from the landing, followed the present line of Prospect Street and the Dundee Drive, Passaic, and thence northward along the line of the present Weasel Road.

Frozen Lumber Will Shrink.

There has been going the rounds of the newspapers a statement that lumber worked when frozen would not shrink. A lumberman, in the language peculiar to his trade, communicated to the *Northwestern Lumberman* his experience in testing the frozen lumber theory.

"I was once running a little mill, and along about the middle of winter we got short of flooring, when an able-bodied liar came along and give it to me. He not only asserted that frozen lumber would not shrink in a floor, but he got on to his hind legs and swore to it. He had known it tried in many cases, and it was always successful and made a better floor than the best seasoned flooring. I was caught. I swallowed it whole. I took green strips, frozen, and dressed them frozen, put them down frozen so hard that you could hardly get a nail through them, and they shrank almost out of the matching. I simply kicked myself for being such an idiot as to believe the story, which is certainly at variance with all natural laws, and have been looking for that able-bodied liar ever since."

A GLIMPSE OF THE PASSAIC RIVER, FROM THE ERIE R.R. BRIDGE.

LOOKING DOWN PAULISON AVE. THE "SHEOWEN HANK" HILLS IN THE DISTANCE.

Phosphatic Slag as a Fertilizer.

As the new basic plant for the dephosphorization of steel at Pottstown, Pa., is expected to be in full blast before the end of the month, the utilization of the slag for agriculture may in time assume importance. As yet it is the only basic plant in America. The *Newcastle Chronicle* thus speaks of its use in England:

The following are additional particulars as to the new idea of utilizing slag for manure: The so-called "basic cinder" taken from the furnaces contains as much as from 14 to 20 per cent of phosphoric acid, associated with a number of other substances, chiefly lime, iron, and alumina; and various processes—more or less expensive—have been applied for the conversion of this phosphoric acid into forms suitable for agricultural use. It has now, however, been demonstrated that the slag or "cinder" itself merely ground into the form of meal has a very considerable manurial value, and when used in sufficient quantity can hold its own against superphosphate and other well-tried forms of phosphatic manure. The experiments of Messrs. Wrightson and Munro have so far only been carried out in two districts, but they are sufficiently striking to suggest a more extended trial of the material, the interest in which centers in the fact that it is a waste product and is cheap. We may add that the number of producers of basic slag in England is limited.

THE Boston and Albany Railroad has a circulating library of two thousand volumes free to its employes.

RESIDENCE OF RICHARD OUTWATER, ESQ., PENNINGTON AND PAULISON AVES.

RESIDENCE OF J. B. HOFFMAN ESQ. PASSAIC AVE.

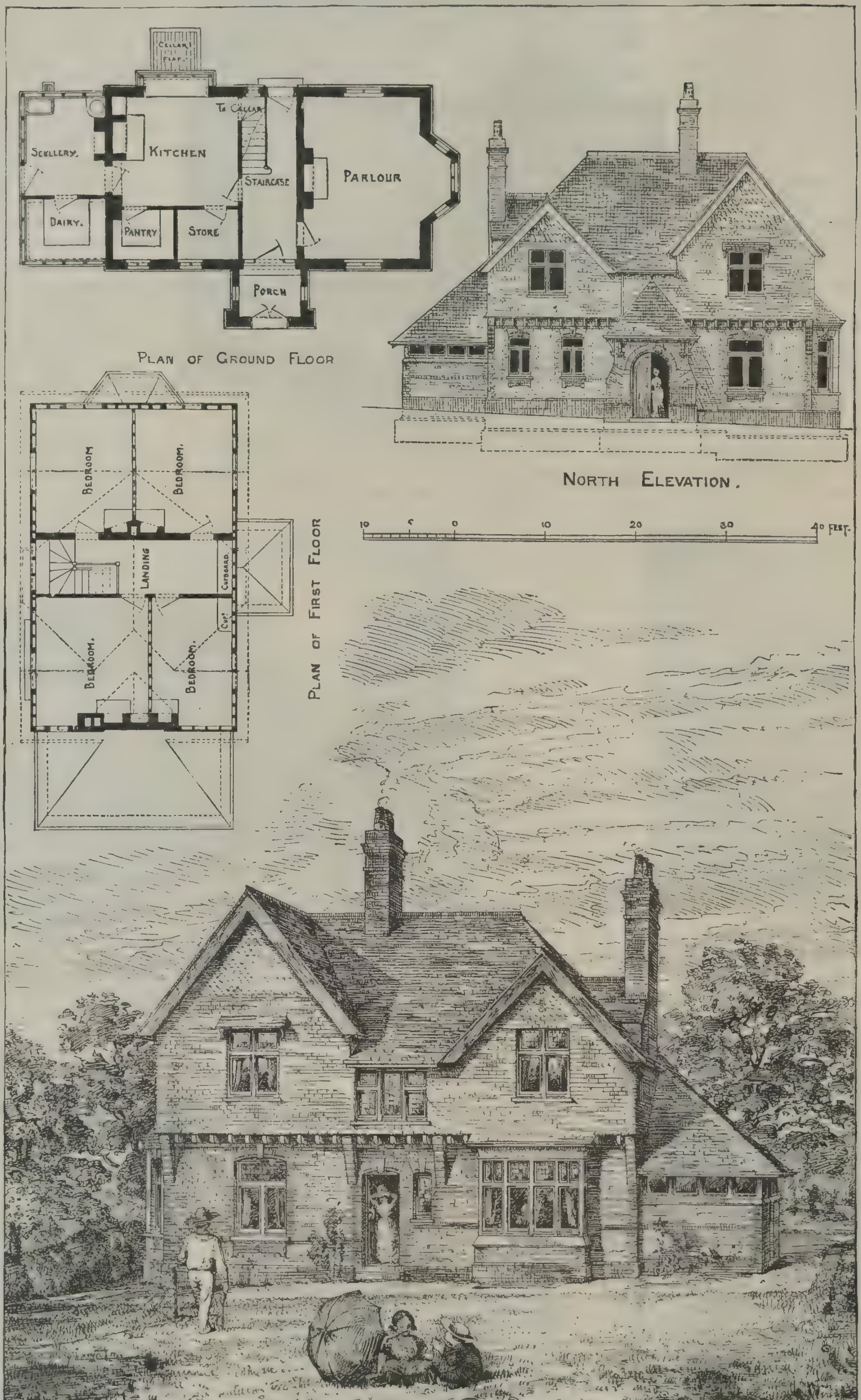
RESIDENCE OF WM. C. McGIBBON, ESQ., PASSAIC AND PAULISON AVES

RESIDENCE OF J. T. GRANGER, ESQ., PARK PLACE.

A SADDLE RIVER "NOOK."—ROAD ALONG THE PASSAIC RIVER.

GROVE FARM HOUSE.

The *Building News* gives the design which we reproduce, for a small farm house or country cottage erected for Lord Ebury. The material is red brick up to the top of the first story and timber and plain red tiles above. A pretty effect is produced by the arrangement of hips and gables and by the manner in which the joists above the first story are brought through and rounded off. Ornamental tiles are used immediately over the upper windows and beneath the gables, and deep large boards tend to increase the good effect. The perspective sketch at the bottom of the drawing represents the elevation of the house on the garden side overlooking the grounds, while the elevation above it shows that of the entrance front with brick porch. The usual accommodation for a small farm house or cottage is provided—four bed rooms, kitchen and parlor with roomy store and pantry and good sized dairy and small scullery or wash-house. The design, which is by W. H. Syme, of the Institute of British Architects, contains many points which could be utilized with advantage.



Grove Farm House for Lord Ebury : W. H. Syme. A.R.I.B.A. Archt.

Cleaning Stonework.

It is sometimes required to clean the surface of old masonry that has become weathered or coated by deposits from dirty water, either for the sake of appearance or to make a sound connection with new work. The only effectual method hitherto practiced for this purpose has been by completely redressing the surface with the chisel—a method which is tedious and costly at best, and which is seldom thoroughly carried out. A different and, it is claimed, more satisfactory process was devised by M. De Liebhabert, and used in 1884 for cleaning the walls of the quays of the Seine in Paris. These walls become in a few years covered with a shiny black deposit, which resists acids. To remove it, a paste composed of a solution of soda and lime, to which a little chloride of lime is added, was mixed to the consistency of honey, and spread over the surface, where it was allowed to remain for two or three hours, according to the condition of the stone. When it was removed, the deposit was still black, but it had become sensitive to acids. After this preliminary treatment, a workman passed over the surface (with a large gutta percha brush) a mixture called sulpho-chlorhydric, forming on the stone a kind of glue; and almost immediately afterward he syringed the surface with a jet of the same liquid. It formed an adherent paste, continuing to act upon the stone for about two or three hours After the syringe came a gang of men who scrubbed the surface, finishing off with a hose pipe. The sulpho-chlorhydric mixture is composed of sulphuric and hydrochloric acids mixed empirically according to the nature of the stone and the necessities of the case. The cost of cleaning stone walls by this method in Paris is 0·46 franc per square meter (or, say, about 4½ *d.* per yard) for material and 0·50 franc for labor, by contract. The preliminary treatment by the caustic paste was paid for separately at 0·50 franc per square meter. It is said that the stone itself is not damaged by this treatment, and soon regains its natural color.

To make a good water stain to imitate walnut, that will not cost too much, take of burnt umber 2 parts, rose pink 1 part, glue 1 part, water sufficient; heat all together and dissolve completely. Apply to the work first with a sponge, then go over it with a brush, and varnish over with shellac.

How to Avoid Premature Old Age.

The following good advice is given by Dr. Benjamin Ward Richardson: The rules for the prevention of senile disease are all personal. They should begin in youth. It should be a rule among grown-up persons never to subject children to mental shocks and unnecessary griefs. When, in the surrounding of the child life, some grave calamity has occurred, it is best to make the event as light as possible to the child, and certainly to avoid thrilling it with sights and details which stir it to the utmost, and in the end only leave upon the mind and heart incurable wounds and oppressions. Children should never be taken to funerals, nor to sights that cause a sense of fear and dread combined with great grief, nor to sights which call forth pain and agony in man or in the lower animals.

To avoid premature old age in mature life, the following are important points to remember:

Grief anticipates age. Dwelling on the inevitable past, forming vain hypotheses as to what might have been if this or that had or had not been, acquiring a craze for recounting what has occurred—these acts do more harm to future health and effort than many things connected with real calamity. Occupation and new pursuits are the best preventives for mental shock and bereavement.

Hate anticipates age. Hate keeps the heart always at full tension. It gives rise to oppression of the brain and senses. It confuses the whole man. It robs the stomach of nervous power, and digestion being impaired, the failure of life begins at once. Those, therefore, who are born with this passion—and a good many, I fear, are—should give it up.

Jealously anticipates age. The facial expression of jealously is old age, in however young a face it may be cast. Jealously preys upon and kills the heart. So, jealous men are not only unhappy, but broken hearted, and live short lives. I have never known a man of jealous nature live anything like a long life or a useful life. The prevention of jealousy is diversion of mind toward useful and unselfish work.

Unchastity anticipates age. Everything that interferes with chastity favors vital deterioration, while the grosser departures from chastity, leading to specific and hereditary disease, are certain causes of organic degeneration and premature old age. Thus chastity is preventive of senile decay.

Intemperance anticipates age. The more the social causes of mental and physical organic diseases are investigated, the more closely the origin of degenerative organic changes leading to premature deterioration and decay are questioned, the more clearly does it come out that intemperance, often not suspected by the person himself who is implicated in it, so subtile is its influence, is at the root of the evil.

When old age has really commenced, its march toward final decay is best delayed by attention to those rules of conservation by which life is sustained with the least friction and the least waste.

The prime rules for this purpose are:

To subsist on light but nutritious diet, with milk as the standard food, but varied according to season.

To take food, in moderate quantity, four times in the day, including a light meal before going to bed.

To clothe warmly but lightly, so that the body may, in all seasons, maintain its equal temperature.

To keep the body in fair exercise, and the mind active and cheerful.

To maintain an interest in what is going on in the world, and to take part in reasonable labors and pleasures, as though old age were not present.

To take plenty of sleep during sleeping hours. To spend nine hours in bed at the least, and to take care during cold weather that the temperature of the bedroom is maintained at 60° Fah.

To avoid passion, excitement, luxury.

Frog's Skin Grafts.

Sometimes slowly healing wounds with feeble granulations are made to increase their activity in the direction of cicatrization by transplanting minute fragments of epidermal tissue containing some of the cells of the rete Malpighii on the healing surface. O. Petersen has successfully used the skin from the back of a frog. The slowly cicatrizing wound was situate on the back of the neck of a man, and had resulted from excision of a malignant pustule. A piece of frog's skin the size of the thumb nail was washed in a 2 per cent solution and placed upon blotting paper, when it was divided into two. The grafts were applied to the wound so that the blotting paper was interposed between them and the fixing plaster. Two days after the transplantation, both fragments of epidermis were found to be adherent. Two days later a fresh grafting was made; the former grafts had become roseate. In a further period of forty-eight hours, the pigmentation of the grafts had almost disappeared. The cicatrix resulting after this treatment was found to be of great softness and elasticity.—*Lancet.*

CONCRETE CONSTRUCTION.

Concrete may be described briefly as pieces and particles of rock or like material aggregated together with lime or cement. The origin of its manufacture is unknown. The massive ruins in Italy testify to its durability and of its extensive employment by the Romans. Since the introduction of Portland cement, the use of concrete has greatly extended. In England, where the first cement was manufactured, Drake states that thousands of concrete buildings have been erected of late years. The great desirability of concrete as a building material is well recognized, and rapid strides are being made in its application. Rapid as has been the increase of concrete building during the past few years, the progress would have been still greater had it not been hindered by the general lack of knowledge on the subject, the great cost of moulding or shaping the material, and the want of adequate appliances for mixing the concrete.

There are many localities where sand rock or gravel can be obtained at a nominal cost, in which concrete could be profitably introduced by any metallurgical man. And in these same districts are men plodding along in the grooves of better known trades who, by turning their attention to concrete construction, could establish themselves in a good business.

To accomplish the best results in this class of construction, it will be advisable to consult Mr. Ransome, who has had great experience in this class of work, and obtain the right of using his patented apparatus, with which buildings can be put up with unskilled laborers, provided the men are intelligently directed.

On this page we give an illustration of a building in process of erection on the system invented by Ernest L. Ransome, of this city. Mr. Ransome has received patents covering building construction, concrete mixer, and a concrete apparatus for moulding walls, houses, and other buildings.

The engraving gives an isometrical view of a building in course of erection, with part of the scaffolding removed. Ransome apparatus for moulding the walls consists of slotted standards, which being placed in pairs, one on either side of the site of the wall, and bolted together, hold in place the mouldboards, between which the concrete is placed. These standards are arranged to slide upward upon the outer face of the mouldboards as the wall progresses, and are made to conform to any breaks or projections that may be required in the building.

The moulding boards may be of any size. If they are permanently required for the apparatus, they should be surfaced and squared, and about 1¼ inches thick, 6 to 12 inches wide, and as long as could be conveniently obtained or handled. If, on the other hand, by reason of the location or other causes, they are only needed temporarily for this purpose, then their dimensions should be determined by their future use. For instance, if they are subsequently needed for flooring, then flooring could be used; if fencing is wanted, then use fence boards; if planks are required, then let planks be taken. In using them for the mould, the boards or planks are but little damaged; the bolt holes required in some of them are not large, and could easily be filled up.

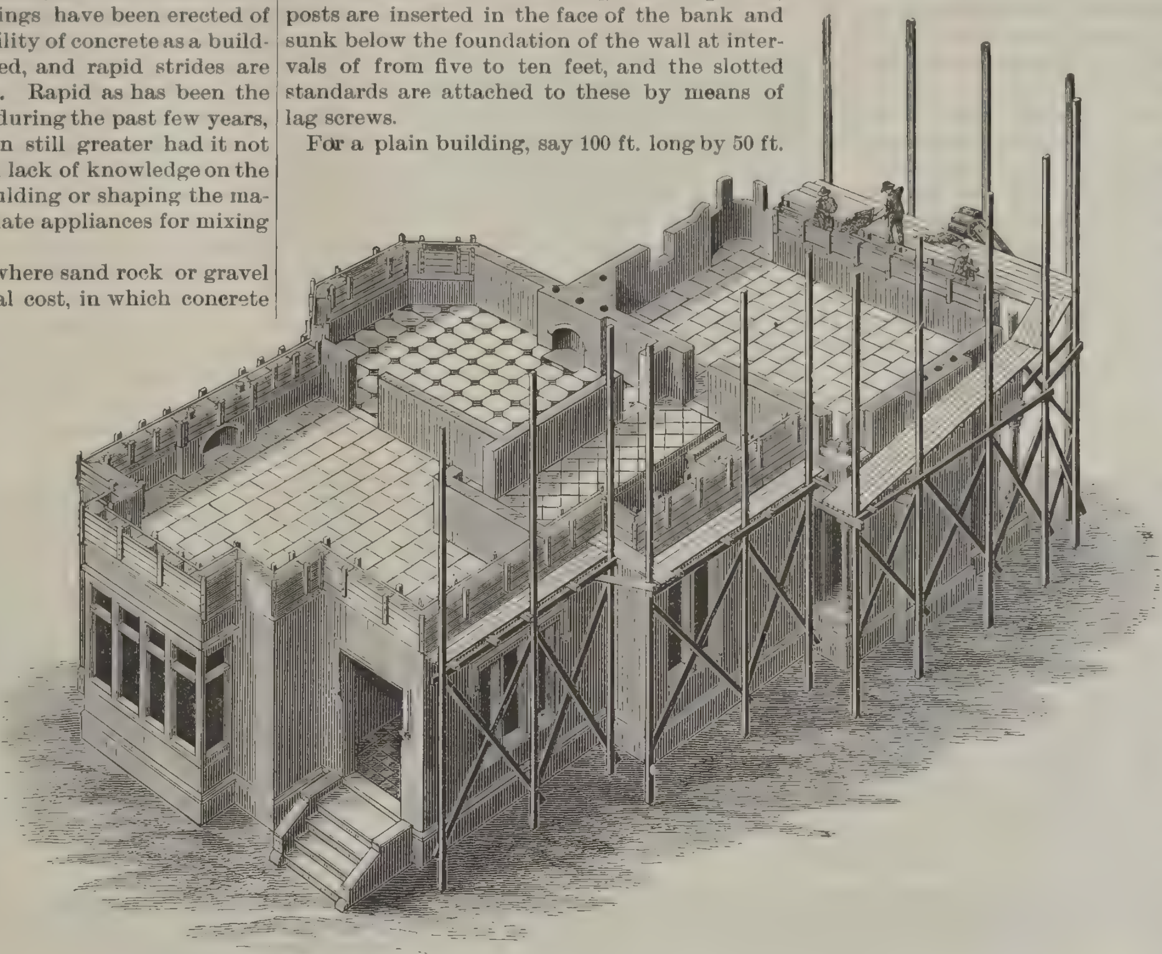
Ordinary bolts may be used for connecting the standards together, but those having winged nuts will be found more convenient. The washers should be of good size.

The *modus operandi* is as follows: The foundations being prepared and the standards and lower moulding boards all in position, concrete is put into the mould continuously, layer after layer. Moulding boards are added from time to time, as needed, until the concrete is brought to about the top of the standards. The bolts are then slackened, a set at a time, and the standards pushed up a few inches, or a foot or two, dependent upon the character of the work.

As soon as the lower bolts are in the way of the upward movement of the standards, they are withdrawn and replaced at the top of the slot. The moulding boards, liberated by these movements, are reused above those already placed as often as needed.

This action is repeated as often as may be necessary to obtain the height desired. It forms a continuous operation, and offers no interruption to the filling in of the concrete. In building retaining walls, posts are inserted in the face of the bank and sunk below the foundation of the wall at intervals of from five to ten feet, and the slotted standards are attached to these by means of lag screws.

For a plain building, say 100 ft. long by 50 ft. wide and 50 ft. high, the cost of the apparatus, irrespective of height, would not exceed $150, and the expense of working it would not be more than a cent per cubic foot of concrete. After building a wall, the apparatus is good for ten or twenty more. By this system the first cost is small and the expense of working slight. There is no difficulty in keeping the wall plumb, and there is no trouble in moulding projections if desired.



ISOMETRIC VIEW OF CONCRETE BUILDING IN COURSE OF CONSTRUCTION.

The large factory and warehouse recently built for the Arctic Oil Works, on the Potrero, were constructed after this manner by the patentee of the system. The fireproof roof of the warehouse was also built by him. Mr. Ransome has built many concrete foundations for buildings, machinery, etc., the largest being that of the Starr & Co. Mills, at Wheatport, Contra Costa County. The foundations of this mill were all built of concrete. In the piers, arches, and floor platforms there are 140,000 square feet of concrete. Mr. Ernest L. Ransome, whose office is at 402 Montgomery Street, San Francisco, California, is prepared to rent tools, sell licenses and territorial rights for his various inventions in connection with concrete construction, and give suitable instruction so that people can build for themselves.

SUGAR, glycerine, and gum arabic are the articles used to produce the glossy appearance of ink.

The Ordinary Vest a Poor Lung Protector.

Mr. James Hess makes a very sensible suggestion, it seems to us, in the *Herald of Health*, when he calls attention to the absurdity of our present curious habit of wearing cambric-back vests, while the fronts are of heavy material and sometimes wadded, and urges the propriety of protection for both sides of the lungs. The habit of course has grown from a belief that the outer coat is sufficient protection for the back, while the chest needs warmer covering on account of the coat being open. But it seems a disproval of the reasoning that the first unpleasant sensations of chilliness are the so-called "creepers" running down the spine. Even when the warmest woolen material is selected for a suiting, the tailor, unless otherwise ordered, will invariably make the back of the vest of some thin, flimsy material, like cambric or silk, though he may deem it advisable to pad the front with cotton wadding. There is no proper reason why the back of the vest should be made so insufficient. The front may be made uncomfortably thick and still fail to protect the lungs, unless the back is made equally thick and warm. In front they are protected about five times as much as in the back by clothing, ribs, flesh, muscle, and fat. In the back, the lungs almost come to the surface, and therefore need more protection. Mr. Hess asserts that it has been his custom for two years past, and that many gentlemen to whom he has mentioned the matter have had their vests made with good, warm backs, and after a winter's trial are quite enthusiastic over the change.

They have passed through the entire winter and spring without once taking cold, which is the best evidence in support of the thick vest-back proposition that could be adduced.

THE LAYING OUT OF GARDEN PATHS.

Where a garden is to be laid out in a perfectly flat situation, there is not, of course, the same scope for effective ornamentation as can be produced where there is a diversity of surface. One means, however, of dealing with level ground is to provide oval and circular and serpentine paths, with plainly marked borders, but so that, to the eye, the lines of the borders will be broken by trees and shrubbery, and the complete plan will not be suggested from what can be seen at any one point. Such walks should, wherever possible, lead to or by some bright little spots which one will come upon unexpectedly, and the surprise of which will heighten the pleasure obtainable from the beauty of the scene. An idea of thus laying out a circular walk may be obtained from the accompanying illustration, the planting of quick-growing shrubbery giving extension and outline to a general direction of paths, which would be governed by any growth, as of trees, that would require years to mature. When a general plan has once been adopted, however, it should be carefully kept in view in all future work in the garden, and the pruning and planting kept steadily in line with the plan laid out.

ART IN THE GARDEN.—A CIRCULAR PATH.

TOBACCO blindness is becoming a common affliction. At present there are several persons under treatment for it at one London hospital. It first takes the form of color blindness, the sufferers who have smoked themselves into this condition being quite unable to distinguish the color of a piece of red cloth held up before them. Sometimes the victim loses his sight altogether. Although smoking is to a large extent the cause of the malady, heavy drinking is also partly responsible.

THE NAUTICAL ARNEA, OR AQUATIC THEATER.

A considerable sensation has been created in Paris by the opening, on the 12th of February last, of an aquatic theater. The spectacular entertainments in which water played an important part date back to the days of the Roman Emperors. The whole arena of the Colosseum at Rome being flooded, mimic sea fights took place, in galleys carrying gladiators, who fought to the death. The Paris circus is remarkable for the beauty of the building and the ingenuity of the engineering details. The following description and engraving are from *Le Genie Civil*, *La Nature*, and the *Engineer*.

In the Rue St. Honore is a building known as the Salle Valentino. This has been transformed—almost rebuilt, indeed—into a beautiful and luxurious circus, to which has been given the title *Arenes Nautiques*. It is intended to fill two distinct purposes—namely, to be used as a circus for equestrian, gymnastic, and aquatic performances during the winter, while during the summer it becomes a huge and splendid swimming bath. The engravings indicate the general arrangements adopted by the architects, MM. Sauffroy and Gridaine. We have omitted the vestibule, foyer, etc. The building was used until recently to exhibit the panorama of Reichshoffen, and the portion of it with which we are concerned is a great circular hall about 110 ft. in diameter. In the lower part of this is a circular tank, 79 ft. in diameter, with a gallery running round it. Over this gallery and the water are constructed tiers of seats, as shown in the section.

In the center is placed a hydraulic ram. To the top of this ram is fixed a huge iron saucer, 44 ft. in diameter. This saucer can be sunk below the level of the water, the surface of which is then available for aquatic performances. When raised up and the water run out of it, it supplies a firm floor for horses and men. All this seems very simple, but the details have required much consideration, and have been very ably carried out.

The building accommodates 3,000 spectators. There are six tiers of fauteuils, which are surmounted by a tier of boxes, above which, again, is a wide promenade gallery, connected with which is a cafe which serves as a foyer, and several bars. The orchestra is placed in a large balcony over the entrance to the stables, which last have stalls for twenty horses. In carrying out the internal arrangements, the contractors had serious difficulties to contend with. The whole of the fittings are removable, in order that the space may be cleared when the building is converted into a bath. The ampitheater of seats and boxes is carried on girders, is supported on twenty iron columns, united by a circular lattice girder surrounding the space reserved for the saucer. This last had to be so constructed as to be quite rigid under the tread of numbers of horses and men, now concentrated in one place, now in another. It must be capable of disappearing during a performance, and without delay. It must, during the bathing season, be maintained at such a height as to provide a shallow bath for those who cannot swim.

To comply with these conditions, the saucer is built up of twenty radial double-flanged girders, riveted outside to a continuous ring of plate iron. The girders are floored with stout planks to make the bottom of the saucer. The hub or boss from which the girders radiate is secured to the top of the hydraulic ram in the center, as shown in the enlarged section at the bottom. The rise of the ram is caused by the action of a four-barreled pump. The saucer is guided in its ascent and descent by planed slide bars round its outer rim. When it has attained a little more than its proper height, it is caused to rotate slightly on its vertical axis by an endless screw; by this means the ends of the radial girders are brought over twenty shoes, fixed to the twenty columns before mentioned as carrying the inner ends of the inclined girders which support the tiers of seats. Then by letting a little of the water escape, the twenty girder ends settle themselves down firmly on the shoes. The inner portion of the saucer is at the same time carried by five stout columns ranged round the ram at a distance of 5 ft. from the center. A star-shaped cross-head or framework loosely embraces the ram at its upper part, where it is retained by a collar; and each ray of the star terminates in a collar, in which is loosely held the head of one of the columns. During the ascent of the ram the vertical columns are raised with it, by means of the star-shaped cross-heads; during its descent the columns enter pipes fixed in the ground, from which they are withdrawn as the saucer rises, until when it is at its greatest elevation they hang quite clear from the cross-head. A movement of rotation carries the columns over saddle plates fixed in the foundations, close beside the mouths of the pipes just referred to. Then, when, as we have said, a little water is allowed to escape, the saucer settles down, its outer edges resting on supports as described above, and the central cross-head on the five columns. To lower it, it is only necessary to raise it a little, turn it round a little on its axis, and suffer it to fall by allowing the water to escape from beneath the ram. The weight of the whole mass moved is about 25 tons. India-rubber buffers and cushions are used to prevent noise and give the whole an even bearing on its supports.

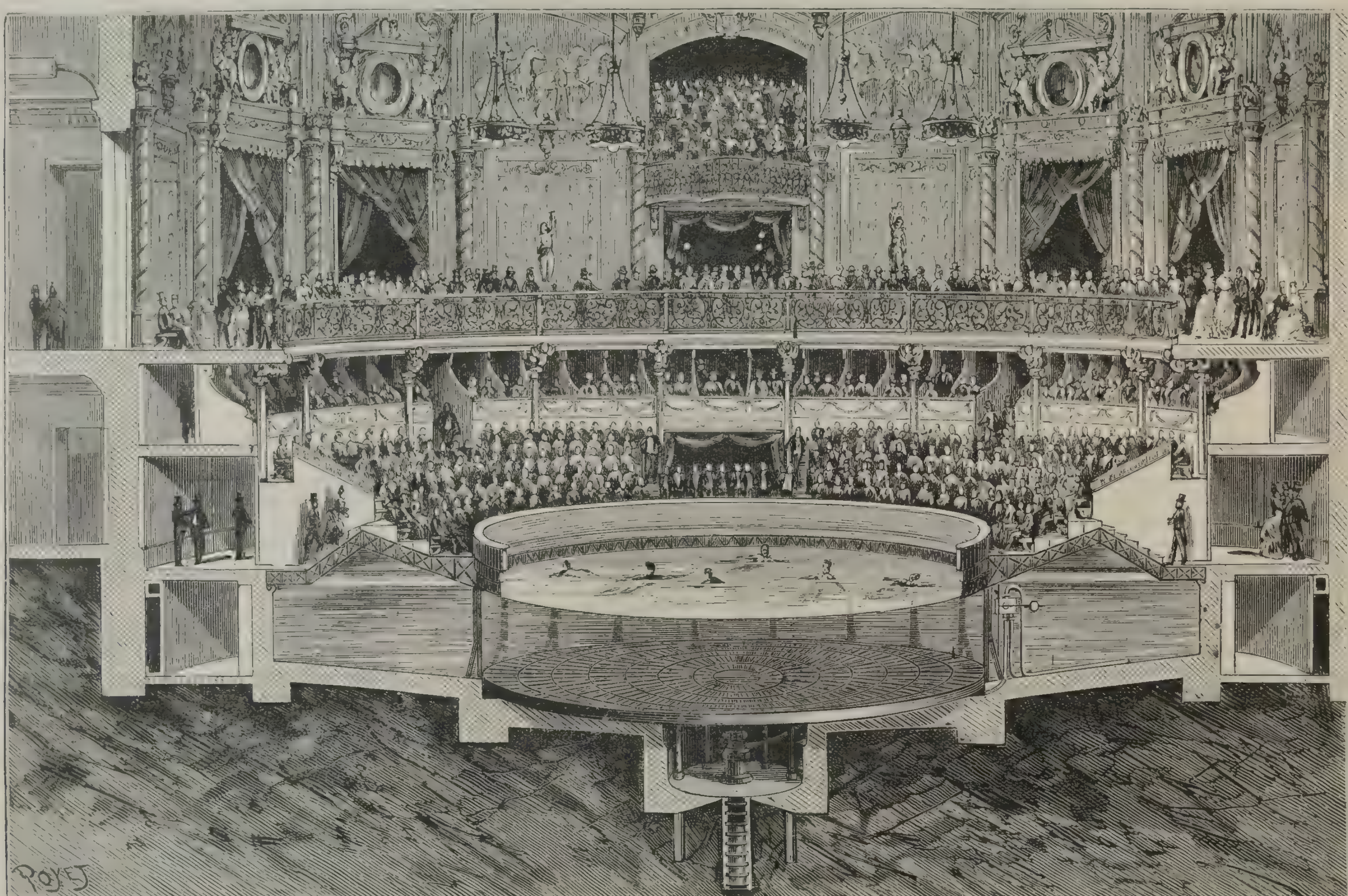
When the saucer is used for equestrian performances its floor is covered with a mat of esparto, weighing about a ton, brought in on two iron carriages. This is said to be much better than sawdust. The rise and fall of the saucer is 10 ft., and the power required about three horses for five minutes.

To transform the hall into a swimming bath, all the seats and boxes are removed, and the saucer is dropped to such a depth below the surface that the water in it is 3 ft. deep; all round it outside is the deep water for those who know how to swim.

The ventilation of a building standing over a lake, as this does, the water in which is always kept at a temperature of 77 deg. Fah., presents difficulties. The vapor rising from this, unless immediately drawn off, would render, by condensation, everything in the building damp. To prevent this a powerful fan, fixed in the cellars, draws the air from a turrent in the roof, and after forcing it through a heating chamber delivers it into the hall under the seats at a temperature of about 86 deg. This would appear to be quite warm enough, but when a higher temperature is wanted the lantern on the top of the building is closed, and the air is then caused to circulate twice through the heating chamber.

All the arrangements for renewing the water are very ingenious, and well carried out. An abundance of water is obtained from a well, which supplies about 50 cubic meters, or 1,755 cubic feet, per hour. There are two distinct deliveries from the bath, one at the surface to draw off scum and froth, and the other at the bottom, which takes off the cooled water which has sunk, leaving the hotter fresh water on the top. The water is heated by the condensers of the electric light engines. M. Solinac is the engineer in charge of this department. Power is supplied by two Corliss 150 horse power engines, driving two alternate-current Maquaire and two Edison dynamos. Steam is supplied by two Collet's water tube boilers. The lighting is effected by twelve Soleil lamps, six arc lamps, ten Jablochkoff lamps, arranged in a crown in the center of the hall without globes, and 2,000 eight-candle Edison lamps, used for decorative purposes.

The whole interior of the building is luxuriously fitted up, and the entertainments provided are of the highest class. On the 12th of February the first part of the programme consisted of that usual in a circus. After the last act the heavy mat was removed, "and then," to quote the words of M. Henri Mamy, "we saw the immense saucer descend slowly, and immerse itself majestically in the waves. When the water began to rush across the flooring in clear view of the audience, the effect was irresistible, and the warmest applause saluted this new attraction, which permitted the audience to realize the progress of modern mechanical science."



THE NEW AQUATIC THEATER, PARIS.

THE following is a fine, lustrous polish for furniture: Half pint linseed oil, half pint old ale, the white of an egg, one ounce spirits of wine, one ounce spirits of salts. Shake well before using. A little to be applied to face of soft linen pad and lightly rubbed for a minute or two over the article to be restored, which should be first rubbed off with an old silk handkerchief. It will keep any length of time if well corked.

SINKING SHAFTS BY FREEZING.

We give the following description from an interesting article recently published in the *Annales des Mines* by Mr. Lebreton. The method consists in solidifying in some degree, by freezing, that portion of the moving and watery earth which occupies the position of the projected shaft, so as to permit of excavating therein by hand, without having much pumping to do. To effect this, there is sunk into the ground a series of vertical tubes that traverse the watery stratum and enter the subjacent solid earth to a depth of from 18 to 24 inches. These tubes are arranged in such a way as to constitute a sort of polygon, that envelopes the section of the shaft with sides of from half a yard to a yard in width. The tubes are afterward hermetically closed at the lower extremity, and, as shown in Figs. 1 and 2, there is placed in each of them a smaller tube for introducing the freezing mixture. A continuous circulation is established by directing the liquid into the central tube, and afterward causing it to ascend in the annular space between the two tubes. The liquid becomes heated in its passage, at the expense of the surrounding earth, whose caloric it absorbs, and, after a certain length of time (provided the difference in the temperatures be sufficient), brings about, around each of the tubes, a congelation of a certain zone that progressively extends until it converts the neighboring parts of the earth into a mass of ice. The excavating may then be proceeded with without any fear of influxes of water; but it is necessary of course to take care to prevent the melting of the ice by keeping up a circulation of the cold current during operations. The liquid used for this purpose by Mr. Pœtsch, the inventor of the method, is a solution of chloride of magnesium, or sometimes of chloride of calcium, which is cheaper. The solution contains 19 per cent. of the former salt, and has a density of 1·17, with a specific heat of 0·9. Under such circumstances it solidifies at about −40°. The liquid is set in motion by a peculiar pump, situated at the left of the mouth of the shaft, in a building which is partially shown in Fig. 2, and is distributed by a large external pipe that runs around the mouth and leads it to the central tubes in the direction shown by the arrows. It rises in the large tubes, and, on reaching the surface, is led by a collecting pipe to a refrigerating machine, in order to be deprived of the heat absorbed in traversing the earth. The closing of the tubes is so perfect that the loss of liquid through leakage is insignificant.

The machine used for the production of cold is that of Mr. F. Carré, which, as well known, operates through a utilization of the affinity of water for ammonia. It permits of obtaining particularly low temperatures of from −25° to −30°, that it would be difficult to get with other types of cold-producing machines. We shall not enter into the details of it, but shall merely say that its mean performance is about 20 per cent. The tubes are sunk into the ground through vertical holes bored through the watery stratum, either by means of the sand pump, if the slight consistency of the earth permits of it, or, otherwise, by hand.

In the application of the method shown in Fig. 2, the tubes rise to the surface of the earth; but if the watery stratum be too far from the mouth of the shaft, the latter may be excavated in full section down to the region of the water, and pipes be then inserted that have only sufficient length to traverse the said stratum. It will prove expedient, moreover, to give the upper part of the shaft a wide section surrounding the polygon of tubes, or at least to widen it at the upper level of the latter, in order that they may be carried back beyond the true section of the shaft.

The tubes used by Mr. Pœtsch are cylinders of 0·15 in. sheet iron 8½ inches in diameter. They are sunk into the earth in measure as the excavation proceeds, and are then hermetically closed in order to prevent an outflow of the freezing mixture. This closing, which has to be done from the outside, is generally effected through the arrangement shown in Fig. 1 (No. 1), that is, through the introduction of leaden plugs, which fit into a conical adjustment at the end of the tube, and which are then covered with a layer of clay or gypsum cement. After this, the small central tubes (which have an aperture at A, in order to allow the current to pass) are inserted.

The cooling action of the liquid at every point of its travel in the interior of the tubes depends essentially upon the difference in temperature between such point of the ascending column and that of the earth. This action, moreover, varies throughout the entire length of the tubes, by reason of the continual exchange that occurs, in two contrary directions, between the surrounding earth and the descending column in the central tube acting as a refrigerant. This fact is ascertained by calculation, and we can likewise determine the conditions that are to be observed in order to obtain a minimum of temperature at the bottom of the tubes, and which permit of securing at this point the widest zone of cold. The frozen region then has the appearance of a surface revolving around the axis of the tube whose meridian is a logarithmic curve that tends to approach the tube at the surface of the earth, according to the outline shown in Fig. 1 (No. 2). Before beginning the excavation, it is necessary to wait in all cases until the zones of ice thus formed around each tube have sufficiently extended to join one another and form a continuous barrier that intercepts all communication with the external water.

In the first application that he made of his method, Mr. Pœtsch effected a complete congelation of the entire region of earth included within the polygon of tubes, and converted it into a compact mass, wherein excavating was performed without any pumping having to be done; but he now prefers to begin the ex-

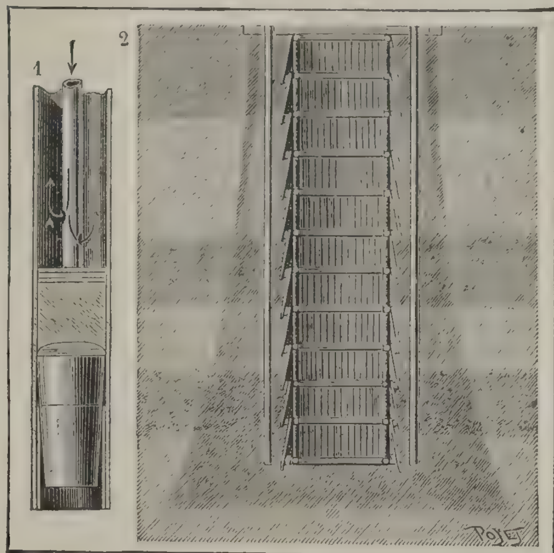


Fig. 1.—THE PŒTSCH METHOD OF SINKING SHAFTS.

cavating as soon as he is able to close the ice barrier, without extending the freezing farther. He thus diminishes, in fact, the time that it takes to effect the freezing, and even that which it takes to do the excavating, since the latter operation is executed under much easier and cheaper conditions in earth without consistency than in ice; and it may even be estimated that the progress is thus quadrupled. The pumping, which is confined to the small quantity of water contained within the column of ice, amounts to little, and does not interfere with operations. The excavating, properly so called, presents, as a general thing, no special difficulty resulting from the low temperature;

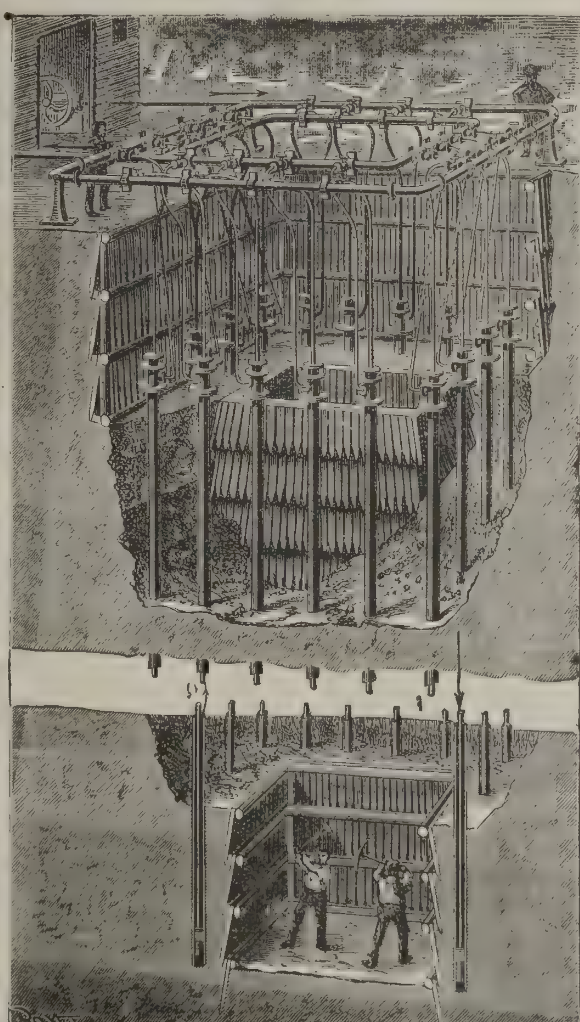


Fig. 2.—SECTION OF A SHAFT SUNK IN WATERY EARTH.

only it is well to put in the timbering pretty rapidly, in measure as the work proceeds, so as to prevent a strain on the wall of ice. The timber used must be very dry, for the freezing of the water contained in the shaft would cause damp wood to fly into splinters.

The Pœtsch method has already been applied in several instances in Germany, and these applications have given results that are generally satisfactory, and have shown how valuable it is for excavating through shifting earth, or earth without consistency. In the most recent application, which was made at the Konigs Wusterhausen mine, near Berlin, the arrangement (Fig. 2) comprised 16 tubes, 9¾ feet in length, 3¼ feet distant from axis to axis, and placed at 20 inches from the edge of the shaft. This latter had a rectangular section of 6½×13 feet. The congelation lasted 50 days, and the block of ice obtained extended, at the surface, to five feet back of the tubes. The volume of water forced into the tubes by the pump amounted to 70 gallons per minute, representing 35·32 cubic feet per tube and per hour. The total cost of the freezing, properly so called, was about forty-six dollars per foot, to which must be added the cost of excavating, say about three hundred dollars, as well as the amortizement of the plant, which carried the total cost up to about one hundred and fifty-three dollars per foot. These figures might doubtless have been sensibly reduced, as Mr. Lebreton remarks, for it is found by calculation that the tubes might have been spaced 5 feet apart, so as to diminish their number, and prevent congelation within the section of the shaft.

It must be observed that the cost above indicated differs but little from that which would follow an application of the ordinary methods to earth of average consistency, but is much less than it would be in an application of such methods to shifting and water earth. This method, then, appears to be peculiarly well adapted for the excavating of such soils, so long as the stratum is not too thick, and there is reason to believe that it will receive numerous applications in the future, not only for sinking mine shafts, but also for founding bridge piers, and perhaps even for driving oblique or horizontal galleries.—*La Nature.*

Ink for Type Writer Ribbons.

Black Record Ink.—Take vaseline (petrolatum) of high boiling point, melt it on a water bath or slow fire, and incorporate by constant stirring as much lamp black (or powdered drop black) as it will take up without being granular. If the fat remains in excess, the print is liable to have a greasy outline; if the color is in excess, the print will not be clear. I am unable to give the proportions more definitely, as I have not made ink enough for manufacturing purposes, but no difficulty will be found in practice. Remove the mixture from the fire, and while it is cooling mix equal parts of petroleum benzine and rectified oil of turpentine,* in which dissolve the fatty ink, introduced in small portions, by constant agitation. The volatile solvents should be in such quantity that the fluid ink is of the consistence of fresh oil paint. One secret of success lies in the proper application of the ink to the ribbon. Wind the ribbon on a piece of cardboard, spread on a table several layers of newspaper, then unwind the ribbon in such lengths as may be most convenient, and lay it flat on the paper. Apply the ink, after agitation, by means of a soft brush, and rub it well into the interstices of the ribbon with a stiff tooth brush. Hardly any ink should remain visible on the surface.

For *blue* "record" ink, Prussian blue may be substituted for the lamp black.

Ribbons Charged with Aniline Colors.—Take about three ounces of water, dissolve in it about a quarter of an ounce of transparent glycerine soap in fine shavings, add one ounce of glycerine, heat the mixture to about 120° F., remove from the fire, and add one-half ounce of the desired aniline color, with constant agitation. This ink can be painted on the ribbon with a soft brush, and needs no tooth brush to rub it in. Nor need the ribbon be taken from the machine in this instance, but the ink can be applied as the ribbon is wound from one spool to the other. If applied hot, it will dry quickly enough on the ribbon. All inks containing glycerine are more or less hygroscopic, and the ingredients may have to be varied somewhat in quantity, according to the season. For instance, in stove-heated rooms in winter, the air is generally so dry that less soap will be required, while in summer more soap may be needed to give the ink sufficient body.

In conclusion, I beg to remark that I do not claim that the processes here given furnish the best results, but they are superior to any I have seen recommended elsewhere. If any of your readers can suggest anything better, I should be happy to try again and let you know the result.—*Isidor Furst, in Amer. Druggist.*

A Labor Paper on Intimidation.

Any man who leaves his employ on account of insufficient wages or other cause, and attempts to prevent another workman from performing the duties that he refuses to perform, is infinitely more outside the pale of toleration than the armed Ku Klux that sought to intimidate white and black Republicans at the South from casting a free ballot. The American people will not for any great period submit to the mob violence that is disgracing our civilization. And any person or organization that contributes to the support of such strikers is just as bad as the law breakers themselves.—*Waltham Tribune.*

* Benzine alone evaporates too quickly, turpentine too slowly. The mixture of the two has answered best in my hands.

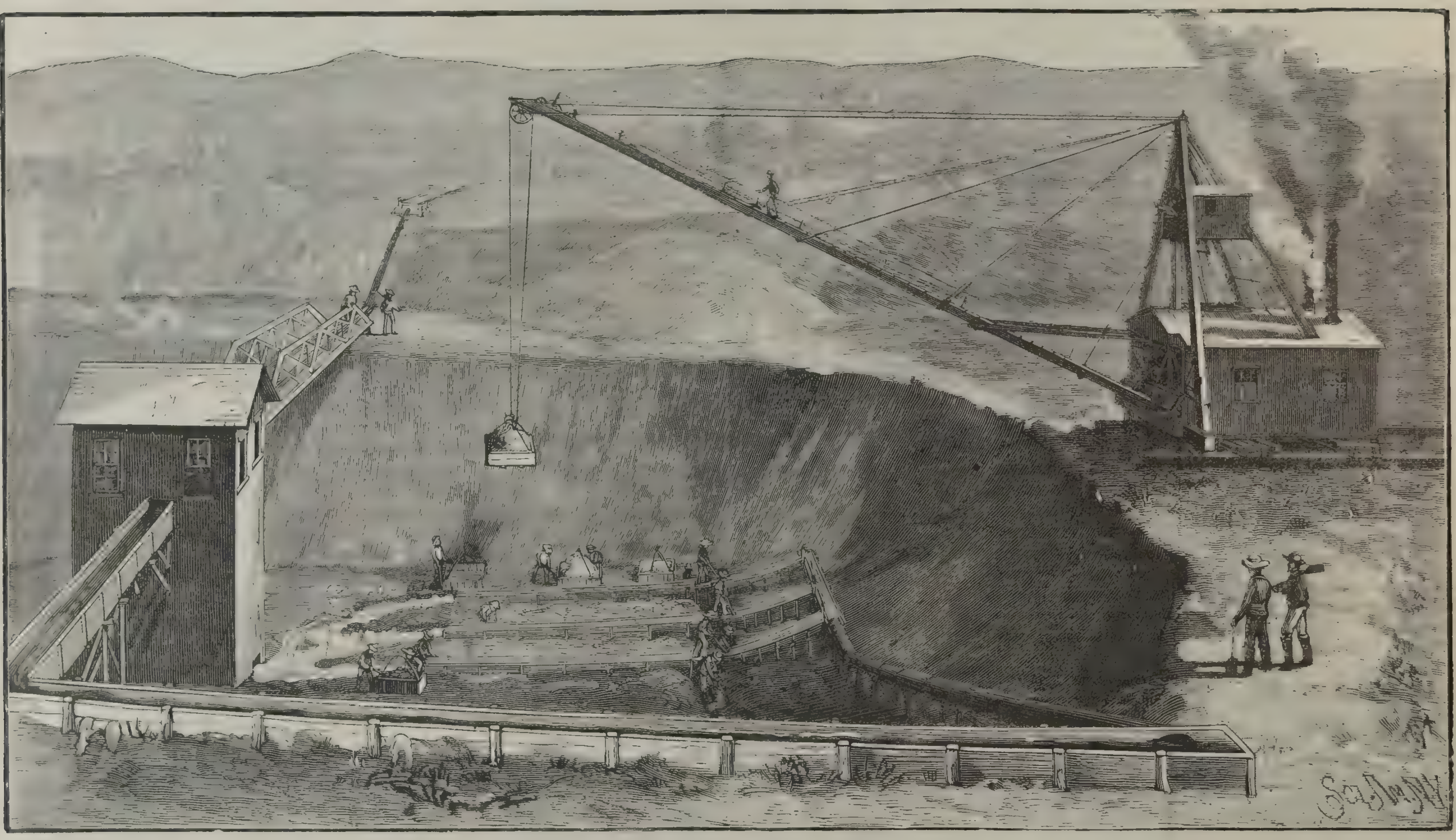
NOVEL MINING MACHINERY.

At the Arroyo Seco Mine, about three miles from the town of Ione, in California, there is now in operation an entirely new method of placer mining. This mine is situated in the bed of a dry creek, which at some remote period had been a river course and had been gradually filled, by the erosive action of the water, until the gold-bearing gravel lay buried under about twenty five feet of dirt and stone. This "pay dirt," as it is called, rests upon bed rock, is from five to ten feet in depth, and quite rich. Although this property has been known to be worth working for a long time, no method of operating was devised until recently, on account of the great quantity of water lying near the bed rock, and for which no drainage could be obtained.

The principal feature of the plan now working successfully consists of a large crane, shown in the accompanying engraving, for moving the waste dirt. The engine and boiler room is built on wheels running on a track, and contains two forty-eight inch upright boilers and a pair of 9×16 inch engines, placed on the same floor as the boilers. These engines move a reel carrying a 1⅛ inch steel cable, that runs out on the wooden boom and operates the box, as shown. The boom is 118 feet long is 12×12 inches at each end, and is 12×24 inches at the center, is well guyed with steel ropes, and is strong enough to raise five or six tons of earth. Operations are commenced by first shoveling the top dirt into the box, then hoisting and swinging the boom at the same time, and finally dumping the dirt in a place completely out of the way. The engineer in the look-out house at the head of the mast attends to hoisting, swinging and dumping the box.

Having thus exposed the pay dirt, water is conducted to the pipe to wash the gravel in sluice boxes, in the same way as that ordinarily pursued in placer mining. The water and sand, after leaving the sluices, flow to the sump, in which there are two submerged centrifugal pumps of peculiar pattern, and which were expressly designed for this work. Each of them has two 11 inch discharge pipes; the capacity is 600 miner's inches of water, or 900 cubic feet per minute. These pumps have no steps or bearings under water, the whole weight resting on two 2½ inch anti-friction wheels. The vertical pumps are run directly by two 15 inch Knight turbine waterwheels, fed from the main supply pipe, the fall being of 74 feet. One of these pumps is capable of raising all the water from the mine together with the sluice water; the other is used during the rainy season of the year.

This machinery was designed and made by Messrs. Knight & Co., of Sutter Creek, Cal., the patentees and manufacturers of the well known Knight waterwheel.



NOVEL MINING MACHINERY, CALIFORNIA.

Some improvement should be made on the ox yoke commonly used. It should so fit the neck that, when at work, the ox may be relieved of pressure on the wind pipe, and avoid galled shoulders, which are quite common. Who will come to the relief of the patient ox?

Wooden Pavements.

During a discussion of the American Society of Civil Engineers in this city of a paper by Mr. E. P. North, on "The Construction and Maintenance of Roads," Mr. Edward R Andrews made the following interesting remarks:

In the West, where stone for pavements cannot be had, wooden blocks are largely used; but, as wood is cheap and can be replaced without much expense, no sound principles are followed in their construction. In the Eastern States, no one will allow that a wooden pavement can be good except when newly laid, when all agree that it is delightful. There seems to be an unwillingness, even among engineers, to give the subject the attention it deserves. All agree that stone pavements are a curse, and that it would be a blessing if a good substitute could be found; but because wooden pavements, as they have been made here, have not been a success, condemn them as a class.

Many methods have been tried, but they have almost, without exception, been "laid with *green* or wet blocks, more or less thoroughly dipped in tar, on a bed of sand, not always well rammed, with or without the interposition of a tarred pine board, with transverse joints from one to one and a half inches wide filled with gravel and coal tar," and I might add, the whole done in a most unworkmanlike manner.

The results are what might have been expected. The careless manner in which the joints have been filled has left many channels open for the admission of water, which undermines the sand foundation, so that there is an uneven subsidence under the passing wheels; and holes, small at first, but daily growing larger, appear, so that the surface is soon destroyed. The result is but little better when tarred boards are laid under the blocks. This practice of tarring wet, sappy boards and blocks seems to be an invention to make them decay as soon as possible. It closes up the cells of the wood, so that the moisture cannot escape; fermentation immediately follows, which quickly destroys the strength of the fibers and reduces them to punk. A pavement constructed in this manner would fail of course. Thoroughly seasoned wood might be benefited by the tarring process, but green wood never.

Observe how differently wooden pavements are constructed in London. Mr. North describes several methods, either of which is vastly superior to any of the patented systems used here. A rigid foundation of bituminous or cement concrete is universal. This costs more than sand, but it is permanent, and will prevent the blocks from sinking under the wheels. English engineers, in discussing pavements, call the foundation the true pavement, the blocks being the wearing surface only. The "Henson" pavement, with some modifications, strongly recommends itself to my mind as the best for this country. Instead of a layer of tarred paper on the concrete, I would use a thin layer of pitch, with oil enough in it to make it permanently slightly plastic, setting the blocks upon it while hot and soft, using the strips of tarred felt between the rows, and driving the blocks together as described by Mr. North. The tarred felt would make a very close joint. Then pour melted pitch over the whole surface, taking care to fill every crevice, and upon this spread fine sharp gravel, which will work in to the ends of the blocks and form a surface resembling macadam, and afford a far better footing than wide spaces between the rows, which serve as receptacles for mud and dust. It is easy to keep this pavement clean. No water can penetrate it, so that it will not be injured by frost. The blocks themselves, if creosoted, will not absorb water; and if laid without spaces between the blocks, the drainage will be surface drainage solely, which is of the first importance.

But the pavement would be short-lived if *green* and wet blocks are used. It is not practicable to use, as Mr. North says is the case in London, "wood better seasoned than the pine generally used by house carpenters in this country." Seasoned wood cannot be obtained in sufficient quantities here. But, what is far better, it can be preserved from decay. I have no faith in any method of wood preservation for paving blocks which does not exclude water. The blocks are so short that any soluble preparation is quickly washed out of them, and, if not made waterproof, they are certain to absorb the seeds of destruction from the filth in the streets. The blocks should be well saturated with creosote oil, whose chemical constituents act preservatively upon the fibers of the wood by coagulating the albumen of the sap, while the fatty matters act mechanically in obstructing the pores of the wood, and keep the water out. At the same time, as oil cannot be injected into wood full of moisture, the thorough artificial seasoning which forms a part of the process of creosoting as carried on in this country, is as useful to the timber as any of the metallic salt processes.

By thoroughly creosoting the blocks, expansion and consequent throwing out of the blocks is prevented. They will not shrink or expand. The wood is also rendered homogeneous, the sap wood becoming as durable as heart wood. Looking to sanitary considerations, the creosoted wooden pavement is perfect. The carbolic acid contained in the oil is a powerful disinfectant, and as the pavement described will not absorb any deleterious substance from the surface, it has only to be kept clean to maintain the best sanitary condition. This is far from being the case with wooden pavements laid on the American plan. They soon become a mass of decaying vegetable matter, and, as their powers of absorption increase with their disintegration, they become filled with corruptible matter absorbed from the filth of the street, and as their surface becomes filled with holes, it is absolutely impossible to keep them properly clean.

A good wooden pavement is also an inexpensive one. The cost, including a cement concrete foundation, 6 inches deep, would not exceed \$3 per square yard. The system of maintenance adopted in London, of making it a part of the contract of construction, would

insure good workmanship in laying the pavement, and a good permanent roadway afterward. It would not be difficult to find responsible and honest contractors willing to take such a contract at a fair price.

In considering this subject, one should not overlook the statistics of accidents gathered in London by Col. Haywood, which show that a London horse will travel on granite 132 miles, on asphalt, 191 miles, and on wood 446 miles, before an accident occurs.

The actual wear of wooden blocks is very slight, as long as the fibers of the wood are sound. Mr. North states that it is one eighth of an inch per annum in the streets in London, with the heaviest traffic. Mr. Geo. Frederick Deacon Member Inst. C. E., in a paper read before the Inst. of C. E., states that in Great Howard Street, Liverpool, which is a shop street, with a traffic consisting chiefly of carriages, amounting to about 94,000 tons per annum per yard in width, the pavement was worn to the extent of $\frac{5}{8}$ of an inch in four years. This would give a life of nearly twenty years before the blocks would be reduced from 6 inches to a thickness of 3 inches, which is still sufficient to maintain the blocks in place.

In Oxford Street, in London, where the traffic is equal to 300 tons per foot per day, the amount of wear has been found to be from $\frac{1}{16}$ to $\frac{1}{8}$ inch during three and a half years. This street is laid with the Henson pavement. This slight wear is largely due to the fact that the ends of the fibers do not broom, and thus retain their original strength.

The cost of creosoting is $12 to $16 per thousand feet board measure.

Spruce does not absorb oil readily on account of the compact character of its fibers, yet it will take in a gallon of oil per cubic foot. Hemlock, pine, both white and yellow, and porous oak, are more absorbent. Wood which is the most destructible, because it absorbs water readily, is really the best for creosoting, as, for instance, the gums and cottonwood.

The amount of carbolic acid in the oil I have not taken any pains to ascertain. The quantity depends upon the character of the coal from which the gas was made, varying from 5 to 10 per cent. It has been ascertained, however, through careful experiments by a Belgian chemist, that the wood preserving qualities of creosote oil are due rather to the waterproofing imparted to the wood by the hydrocarbons contained in it than by the carbolic acid. The latter is very volatile, and were it not retained by the gummy, resinous oil, would quickly escape into the air. In England no reference is made to the quantity of carbolic acid contained in dead oil to be used in the specifications for contract work. Carefully conducted experiments of my own with pieces of yellow pine, 8 inches by 8 inches and 9 feet long, have shown that six months after treatment they did not absorb any water during a soaking of 48 hours under water.

The Electrical Tramp Protector.

A recently married electrician, says the *Electrical World*, who lives near Sacramento, Cal., has devised a scheme for protecting his wife from the annoyance of tramps. The vagrants invariably sought the kitchen *via* a rear stairway, so the electrician detached the four bottom steps from the others, and attached a powerful battery to them. A wire from the battery runs into the kitchen, and when a tramp is seen approaching, all that is necessary is to touch a spring at the proper moment, and the astonished seeker after provender is thrown nearly over the back fence.

NEW CLUB HOUSE OF THE ST. LOUIS JOCKEY CLUB.

The illustrations herewith bring at once before the mind a good idea of the general plan and principal details of a new club house now being erected by the St. Louis Jockey Club, which it is expected will cost $50,000.

Externally, the outline of the building, as presented in the view from the southeast, is broken into many projections—towers, gables, galleries, and porches being combined in such a way as to present a most attractive appearance; but on the opposite side, that which looks toward the race course, there are to be two lines of galleries, 16 feet wide, running the entire length of the building, the ends shown at the right in the first engraving indicating their position.

The second line of balcony and porch will have its floor stepped from the face of the porch back to the wall of the building, as with a grand stand, to give the occupants a better view of the races. The interior of the edifice will be handsomely finished and tastily furnished, after the designs shown in the engravings, for the use of members of the association and their families. Bowling alleys, a billiard room, and gymnasium are to be included in the arrangement.

The floors will be of polished yellow pine, and the basement and first and second stories will be finished in hard wood. The walls of the ladies' reception room are rough cast, and are to be finished with gold bronze. The second story is to be devoted to private parlors and dining rooms. The main hall has the principal staircase recessed in it, inclosed by arches and lighted by a skylight.—*Illustrated Graphic News.*

SOUTHEAST VIEW OF CLUB HOUSE.

THE MAIN HALL AND STAIRWAY.

LADIES' PARLOR.

THE ST. LOUIS JOCKEY CLUB HOUSE.

Steam and Gas Engines.

The last *Bulletin* of the Northern of France Industrial Society contains a very interesting study by M. Witz upon the parallelism of heat engines. The practical problem of the transformation of heat into work has been solved in various ways with more or less success. The steam engine has carried the solution farther than other machines. Theoretically, the steam engine does not realize the ideal; but, from the utilitarian point of view, its pre-eminence is indisputable, because its movement is very sure, very regular, and its duty is satisfactory. Hot air and gas engines belong to a more perfect type of motor engine, but their cycle is hardly yet understood, and very imperfectly realized. The parallel which M. Witz wishes to establish is stated as follows: The cycle of the steam engine is less perfect than that of air and gas engines, but it is better realized. It is consequently less perfectible. To establish this thesis, it is necessary to calculate the value of the coefficients of duty of various engines. The duty r of a cycle is equal to the ratio of the quantity of heat utilized to the quantity utilizable. The ratio of this duty r to that given by a cycle of Carnot, between the same limits of temperature, constitutes the generic duty r_1 of the motor in question. The duty r depends only upon the possible fall of temperature between the generator and the refrigerator. It is by the value of r that the worth of a motor can be judged. This coefficient cannot exceed 0·60; it is therefore necessarily much below unity. The generic duty r_1 depends upon the more or less perfect realization of the theoretic conception of the engine. It is higher as the construction and fitting of the engine are improved. For a machine perfect of its class, this ratio will equal unity. These two duties r and r_1 permit of the valuation of an engine from a double standard. For any motor r is determined by its constitution; while r_1 expresses the degree of perfection with which the constitutional idea is embodied. The former can never be altered; but the latter may be the object of continual attempts at improvement. Motors having a high duty r are the motors of the future; those with a ratio r_1 near unity are those which, having attained the perfection of which they are capable, can only make insensible and slow progress. Take the examples of an Ericsson and a steam engine. Here we have in the former a limit of temperature (absolute) of 523° to 323° C. The ratio r is 0·22, while r_1 is 0·58. With the latter the limits are 432° and 319°; r being 0·17, and r_1 0·65. The former cycle is manifestly more advantageous than the second, but the latter is better realized.

For the future, it is reasonable to believe that the steam engine will find serious competitors in the hot air and explosive gas engine. M. Witz recognizes that the price of a calorie of gas is higher than that of a calorie of steam; but declares that a "gas engine, supplied by town's gas, is in the same inferior circumstances as an electro motor supplied from a battery." The gas should be specially generated for motor purposes, just as steam is in boilers.

Natural History Notes.

The Age of Fish.—Many statements have been made as to the great age that fish may attain. Some persons think that there are carp at Fontainebleau that date back to the time of Francis I., but the majority is skeptical in regard to this, and for good reasons. Professor Spencer F. Baird thinks that we may allow an age of 200 years for certain carp. There is nothing, says he, to prevent fish from living almost indefinitely, since they have no period of maturity, and grow every year of their life. In Washington there are goldfish that have belonged to the same family for fifty years, and they appear to be scarcely any larger than they were when purchased. In the royal aquaria at St. Petersburg, there are fish that are really 140 years old. Some of these are fully five times larger than they were when introduced, while others have gained but a fraction of an inch in length. It appears that in China there are sacred fish of still greater age.

A Gigantic Sea Weed.—Captain John Stone, commander of the ship Clever, recently carried to Montevideo some remains of a gigantic sea weed that he picked up near the equator. While overtaken by a dead calm in these regions, the sailors perceived an object floating on the surface at some distance from the ship. Manning a boat, they rowed out to it and found to their surprise that it was an alga of the extraordinary length of over fifteen hundred feet. From an examination of the specimens collected, botanists identified the plant as *Macrocystis pyrifera.*

Deep Water Fauna of the North Atlantic.—In a recent paper by Professor S. I. Smith on the decapod crustaceans dredged by the Albatross in the North Atlantic, the author remarks that at least a third of all the species taken came from depths greater than a thousand fathoms, and a number were remarkable for their large size. One Brachyuran had a carapace five inches long and six broad, and some specimens of an Anomuran measured, with outstretched legs, over three feet. Some of the species were nearly colorless, but most were of some shade of red or orange. As regards eyes, eight out of twenty-one had normal black ones, two had abnormally small ones, three had eyes with light colored pigment, and of the rest the function was doubtful. Of five species from below two thousand fathoms, one had normal, well developed eyes, while the eyes of the rest were small, imperfect, or doubtful. From these and other facts, Professor Smith draws the conclusion that, notwithstanding the objections made by physicists, some light penetrates to a depth of over two thousand fathoms, and, in view of the purity of the water in mid-ocean, he sees no reason why light should not reach that depth as easily as it does five hundred or two hundred fathoms nearer shore. However this may be, he finds that there is a tendency toward a radical modification or an obliteration of the normal visual organs in deep water species.

The Enemies of the Oyster.—In a recent number of *Science*, Mr. R. S. Tarr gives some interesting details in regard to the habits of two enemies of the oyster, studied by him—*Asterias Forbesii* and *Eurosalpinx Cinerea.* The former of these approaches the oyster, which naturally is powerless to move, and lies upon its shell. It then proceeds to attack its victim's stomach, and in so doing secretes a peculiar liquid that seems to weaken or kill the oyster, so that the latter remains with its shell partly open. After a while, the Asterias has absorbed sufficient of the oyster, and takes its departure, leaving its victim to perish. Getting hungry again, the Asterias begins upon another oyster, eating a small portion as before, and leaving the rest without ever returning to it. It appears that at times an oyster bed will be entirely taken possession of by these animals and be wholly destroyed in one night. Mr. Tarr thinks the only remedy is to find whether there is not some mollusk that the Asterias might like better than the oyster, and, if there is, to rear this in the vicinity of oyster beds in order to satisfy the starfish's voracity.

The Eurosalpinx, by means of its odontophore, bores a hole into the oyster's shell with amazing rapidity, and then scrapes out the flesh and feeds upon it. After a short period of rest it passes to another oyster, and so on. In both cases the victim is fatally injured, and soon dies. According to Mr. Tarr, these two enemies are the cause of very great mortality among oysters.

Influence of Electricity on Plant Roots.—It is a fact generally known to botanists that the roots of aquatic plants incline to one side or the other when an electric current is passed through the water in which they grow. Mr. Elfring was the first to observe this fact, as long ago as 1882. He found that the majority of the roots examined by him curved positively, that is, toward the anode; others, on the contrary, curved toward the cathode; and, finally, some exhibited an inclination whose direction it was difficult to determine. Mr. Elfring endeavored to explain this phenomenon by saying that the current, acting upon the protoplasm, produces a diminution in the turgidness of the cellules, and consequently a retardation in the growth; and this retardation being different at various points of the root, there results a curvature of the latter.

A little later, Mr. Brunchorst thought that he had discovered that the curvature depended solely upon the intensity of the current, that is to say, that a current of feeble intensity produced a negative curvature, and one of strong intensity a positive one.

More recently some researches on this subject have been made by Mr. Rischewi. According to the theory which he espouses, the curvatures are attributable to cataphoric action. This scientist bases his theory upon the well known experiment of Dr. Du Bois Reymond, in which two cylinders of coagulated albumen, placed between the electrodes, show an inflation at the negative electrode and a contraction at the positive. This phenomenon is due to the fact that the water in the cylinder moves, under the influence of the current, in the direction of the latter. Roots afford another example of such action. As the turgidness of the cellules increases on the side next the cathode, this side elongates, and a positive curvature is produced. The negative curvature is explained by the diffusion of the external liquid in the porous roots, this occurring on the side next the anode, when a current of feeble intensity is made to pass.

The Velocity of Meteors.

About six weeks ago, we referred to the fact of an extraordinarily brilliant meteor having flashed across the sky in this neighborhood, and we invited communications upon it from any who might have observed it. It seems that upon the same night a similar meteor was observed in England. Now, under ordinary circumstances, there was nothing notable in this, for meteors are known to be continually falling, it having been calculated that many millions of them fall annually upon the earth. But that one should fall of exceeding brilliance, and described in almost identical language by correspondents in the *Times* and by ourselves, is worthy of note and of further inquiry. We recorded that such a meteor appeared at 27 minutes past 12 in the direction east-southeast from Cumballa Hill, from which place it was seen. It was subsequently reported from Rutnagherry that a meteor was seen there, but to the north. A correspondent wrote us from Mahableshwur, who reported that he saw a very bright meteor at half past 1 (local time), but the great difference in time pointed to some error in recording the exact appearance, or else proved that it was some other meteor that was seen. In England there was a meteor which seems to have passed over London about 5:5 P.M. Greenwich time, or 9:55 P.M. Bombay time; and it appears to have been traveling eastward. It does not seem beyond the bounds of possibility that the meteors seen here and in England were the same. The absolute difference in time would thus be 2 hours 32 minutes, which is equal to the time taken to travel the distance between these two points. Assuming this distance to be about 5,500 miles, the rate at which the meteor was traveling was about 35½ miles a minute in the earth's atmosphere. The rate at which meteors travel in interstellar space is about 40 to 50 miles per second. So that the difference between these two rates of speed shows the retardation due to the earth's atmosphere, always going upon the assumption that the meteor seen in England was the same as that seen here. To settle this point, it will be of interest to know if any one between Bombay and London noticed the brilliant meteor of the 16th of January, and it would also be interesting to know if any one saw it on the other side of India and further east. Though meteors or meteorites fall in such great numbers, it is very rarely that their history can be traced, and it appears that a service may be done to science by tracing out the path of this particular one, if so be that two points in its journey have been fixed.—*Times of India, March* 6, 1886.

A NOVEL MODE OF FEEDING LAMBS.

NOVEL MODE OF FEEDING LAMBS.

The device for feeding lambs is so simple and so well delineated in our excellent engraving as to require but very little description.

It may be well to state that the reservoir containing the milk should be kept clean and sweet, and fed to the lambs at about the normal temperature of the animal.

The sooner after birth the lambs are introduced to this mode of artificial feeding, the less trouble will be experienced in the weaning process. The lambs should be fed regularly, not less than three times a day. In France, where the invention has been introduced quite extensively, it is said to have proved very satisfactory.

The Paris Metropolitan Railway.

The capital of the company for the promotion of the Metropolitan Railway for Paris is to be 50,000,000 francs. The plan comprises (1) an inner circle line along which the rails will pass, according to the nature of the ground traversed, underground through cuttings or over viaducts; (2) two great arteries destined to connect the stations of the great companies and intersecting Paris. One underground will connect the Gare de l'Est, pass through the district of the General Post Office and Halles, and terminate at Mont Parnasse Station; the other, which will be above the surface level, will connect with each other (1) the Saint Lazare and the Nord stations by a line which will pass through the Carrefour Drouot; (2) the two stations so united of the West and North with the Vincennes and Lyons stations by means of a line passing from the Carrefour Drouot and leading toward the Avenue Daumesnil by crossing the district of the Halles, which, serving as a point of intersection of the above-ground artery and the underground artery, will thus have exceptional advantages. The contemplated stations number 64, of which 28 are to be on the viaduct, 15 over open cuttings, and 21 over the underground way.

Mistakes in School Architecture.

The miserable school buildings of the past, when school months were few and the average years of study less, were bad enough; but how entirely inadequate in their provisions and utterly absurd are they now, when we consider the needs of the more studious and less active race of to-day. It is astonishing how many so-called modern school buildings are being erected in utter disregard of all hygienic requirements. The main idea seems to be inclosure. The vital principles and demands of optics, acoustics, respiration, ventilation, sewerage, and physical exercise are entirely ignored. For six hours a day and nine months per year children are huddled together in miserable rooms, where improper lighting and stagnant atmosphere make one feel that God's free sunshine and pure, invigorating air are expensive luxuries.

For these mistakes are responsible conjointly the people, school boards, and architects. The people in the first place, because they constitute the public, and the public in this country is everything. By their false ideas of economy, their ignorance of hygienic principles, and their demands that architecture should be without rather than within, buildings are erected totally unworthy of the great and honored use for which they are intended.

The wants of the school and the general features of the building should be determined. After that it pays to employ only the best architect, one who in the arrangement of his plans can bring to bear years of study, extensive observation, wide views, and successful experience, one who may have made mistakes, but never the same mistake the second time. Such a man in the construction of a building, small or large, is worth more than the cost of the building itself. It takes brains as well as brick and mortar to make a well constructed building.

But even among architects there are many quacks, cranks, and other dangerous leaders. As in other professions, many a man is in demand and is successful who never merits success. The obtaining of employment and the making of money determine the plans of the architect far more than the higher possibility of his work. Architecture is an art, and should never be prostituted to a baser position. By this I mean that the architect should be a man devoted to his work and unyielding in his convictions and principles, preferring rather to lose a contract than to erect an ignoble building.

I take it for granted that in every well-ordered community the schoolhouse should be pre-eminently the building of the locality. The building should be centrally located and accessible, but never so at the expense of healthiness of site, proper size of ground, and freedom from noise. An even but moderate slope, south preferred, with perfect facilities for sewerage and drainage, is desired. The site should furthermore be remote from railways, noise of busy streets, mills, and factories, and from rivers, canals, places of amusements, breweries, and all penal and objectionable institutions. The grounds, at least in cities of the second class and smaller, should be not less than two acres for a building of four rooms, with an additional acre for every other four rooms.

The school building should never be more than two stories and basement in height. Less than this is frequently desirable, provided the ventilating stack can be sufficiently high to perform its work properly. The ceiling of an ordinary schoolroom should be from thirteen to fourteen feet high—more is a disadvantage—and the basement eight or nine feet high. If the basement is to contain playrooms, it should be one-third under ground; but if not, then nearly all. In the entire arrangement of the building the aim should be to reduce as much as possible, and to render easy, the climbing of stairs. The angle of ascent should be about 30 deg. It would be well, when possible, to have a separate flight of stairs for high school pupils. In passing from one floor to another, the stairs should not be continuous. The rest that comes from a landing is worth many times the disadvantages, not to speak of the economy of room and the check in case of fall. As has been indicated, the rooms should never be located in a third or fourth story. The custom of locating a school hall or audience room in one of these higher stories is also objectionable. School buildings should and must be so constructed as to reduce the climbing of stairs to a minimum.

The lighting of the schoolroom should be ample. The window space should never be less than one-fourth of the floor space, but of course this ratio is subject to the surroundings of the building. Forty per cent is little enough in some localities. When the lighting must be from two sides, these sides should be left and rear, but never left and right. In the reports on this subject of the schools in an adjoining State, 97 per cent of the schoolrooms receive their light from both right and left—many from the rear also, and nearly 10 per cent from the front. It is apparent that the many angles of light so given must cause the most deleterious effects on the eyes of the pupils. I would prefer a unilateral light from windows very large or so arranged in groups as to give admittance to a few broad bands of light rather than to many streams of light from numerous smaller openings. The color of the walls within the room deserves consideration. The old-time white wall is irritating to the eye, especially in cases of lymphatic and scrofulous tendencies. The walls and ceilings should be delicately tinted. Paper is objectionable. A hard surface, which can be readily washed and does not absorb floating disease germs, is to be recommended. Blackboards should be reduced in size to the actual necessities of use.

The ordinary schoolroom should not exceed fourteen feet in height, nor contain more than 900 feet of floor space. The room should be thirty-two feet long and from twenty-five to twenty-eight feet wide. Greater dimensions are neither comfortable nor convenient. Forty pupils are enough for one room, and never should the number exceed fifty. The floor should be of hard, polished wood, which absorbs little and is easily cleaned. The above proportions would give each pupil at least twenty square feet of floor space and three hundred feet of air space.

Whatever may be the means of heating a building, the ventilation should be perfect. If by hot air, the furnace should be large, so as to heat by a large quantity of hot air, and also to keep the temperature of the rooms from fluctuating. The temperature between the floor and ceiling should never vary more than 5 deg., and should not differ greatly for different parts of the room. The furnace should be centrally located, so as to transmit heated air by flues in interior walls, and to rooms of any given floor by flues of equal length.

Except in mild weather, the windows should never be opened for ventilation, as such openings give rise to dangerous draughts and do not remove the carbonic acid gas, which accumulates near the floor. The ventilation should be near the floor, which equalizes the temperature at all parts and heights of the room and removes all layers alike. Any system of ventilation that does not supply each pupil with 1,500 cubic feet of fresh air per hour is bad indeed. Each should have 2,000 cubic feet. This in a room of forty pupils would necessitate the pouring into the room of from 60,000 to 80,000 cubic feet of air per hour; with fifty pupils, 70,000 to 100,000 cubic feet would be required. Now, it is apparent that no natural flow of air over the furnace would be able to supply this enormous demand of each room, which would necessitate a change of air every ten or twelve minutes. Hence, mechanical means must be used to create a draught. There are many contrivances for doing this, but the most economical is by conducting all the waste air through the floor space or chutes to a ventilating stack, in which a powerful ascending current or suction is created by heat, either by the smokestack passing through the center of the ventilating shaft, or from gas burners, or other means. At Elmira, N. Y., some years ago, the shaft opened into a room in the garret, where a stove caused a suction from below. But this plan is not so good or economical as that which I have mentioned, and now in successful operation in the Sidney schools and elsewhere, by which is utilized the otherwise wasted heat of the smokestack in producing the desired suction from the rooms. The greatest care, however, must be exercised in making perfectly air tight all the passages through which the air is to travel. Even the porous nature of brick requires a hard finish of plaster or paint to make it impervious. The impossibility of making the confining surfaces of the air space under the floor even comparatively air tight renders questionable the propriety of utilizing all of this space for ventilation. The argument that such ventilation warms the floors by the air in exit is not valid, as the floors should never be allowed to get cold. The better plan would be to conduct the waste air from one or more openings in the floor to the ventilating shaft by well constructed chutes, simple in size, direct in course, and as short as possible. For all rooms, the distance the air travels from registers in hot air flues to the ventilating stack should be the same. The value of such a system of ventilation cannot be overestimated. Under the action of powerful suction, the building literally breathes. Because of the heated condition of the ventilating shaft, I have known the current to flow for hours after the fires in the furnaces were out. The demands of sanitary science should be incessantly and loudly heard until such a system, or one equally good, is adopted in every school and other public building in the land.

The closets should be within doors, and should be as neat and attractive in appearance as the rest of the house. If the water supply is ample and sewerage adequate, closets should be placed on each floor, with washrooms adjoining; but, if not, then the foul and unhealthy water vaults should be abandoned and, in their stead, earth or dry closets used, thoroughly deodorized and frequently emptied. In this latter case they should be placed in the basement adjacent to the ventilating shaft. The complete change into gases and consequent removal can be satisfactorily effected by a strong hot current from the furnaces.—*Abstract of paper read by Prof. P. W. Search, superintendent of public schools, Sidney, O., before the Ohio State Sanitary Association, Feb.* 24, 1886.

Cost of Different Kinds of Walls.

The following, from the *National Builder*, shows the comparative cost of frame, brick, and stone walls.

The first idea that naturally suggests itself, after the general plan of arrangement has been perfected, is what material shall mainly enter into the construction of a building, brick, stone, or wood. In nearly every portion of the Eastern, Middle, and Western States, these three building materials can readily be had, and the cost of production does not vary much in any locality. Assuming, therefore, that the first cost is the same in the above localities, we may easily arrive at the ultimate cost of construction. For the purposes of this article, we may assume the cost of good common brick, during the summer, to be $8.00 per thousand; cost of labor and mortar to lay the same in the wall, $4.00 per thousand, wall measure. The cost of good quarry stone, assumed at $10 per cord; the cost of labor and mortar to lay the same in the wall, $8 per cord of one hundred feet. The cost of framing lumber, $12.00 per thousand feet; labor and nails to put the same up, $6.00 per thousand. With these prices as a basis, it is a matter of computation only to arrive at the proportionate cost of each material after it has been worked into the walls. As an example, suppose we have ten feet square of plain wall to build, what will be the comparative cost? Ten feet square equals one hundred superficial feet. If to be built of brick twelve inches thick, estimating 22½ brick to the superficial foot, would take 2,250 brick; cost in wall per thousand, $12.00, equals $27.00.

To lay a good rubble stone wall, it should be 18 inches thick; therefore, 10 feet square, or 100 superficial feet, of stone wall 18 inches thick, at $18 per cord of 100 feet, would cost $27.00. In estimating a frame or studded wall there should be included, first, the studding, say, 2 × 8, 12 inch centers; second, the outside sheathing of 1 inch surfaced boards; third, the siding of clear pine. For this example we have placed the cost of rough lumber at $18.00 per thousand, put up. We will assume the cost of the inch surfaced boards for sheathing to be $25.00 per thousand, including labor, nails, and material. Siding at $40.00 per thousand, including lumber, labor, nails, and waste. Ten feet square, or 100 superficial feet, of 2 × 8 studding, at $18.00 per thousand, equals $2.43. The same surface, covered with surfaced boards at $25.00 per thousand, costs $2.50; 125 superficial feet of siding, at $40.00 per thousand, equals $5.00, allowing one-quarter for lap and waste. Thus we find the total cost of the frame wall to be $9.93. Add to this the cost of painting the same, one square, at $3.00, we find the cost to be $12.93. Comparatively, therefore, we find the cost of 100 superficial feet of wall built of the three leading building materials of the country as follows:

Common brick	$27.00
Rubble stone	27.00
Frame	12.93

The cost of window and door frames, cornices, etc., may be estimated about the same in either building. In brick and stone buildings we find the additional cost of cut stone window and door sills, water table, etc., but the cost of these adjuncts does not enter into the first cost of the walls, and should rather be estimated on separately or considered as additional items of cost that may be dispensed with if necessary.

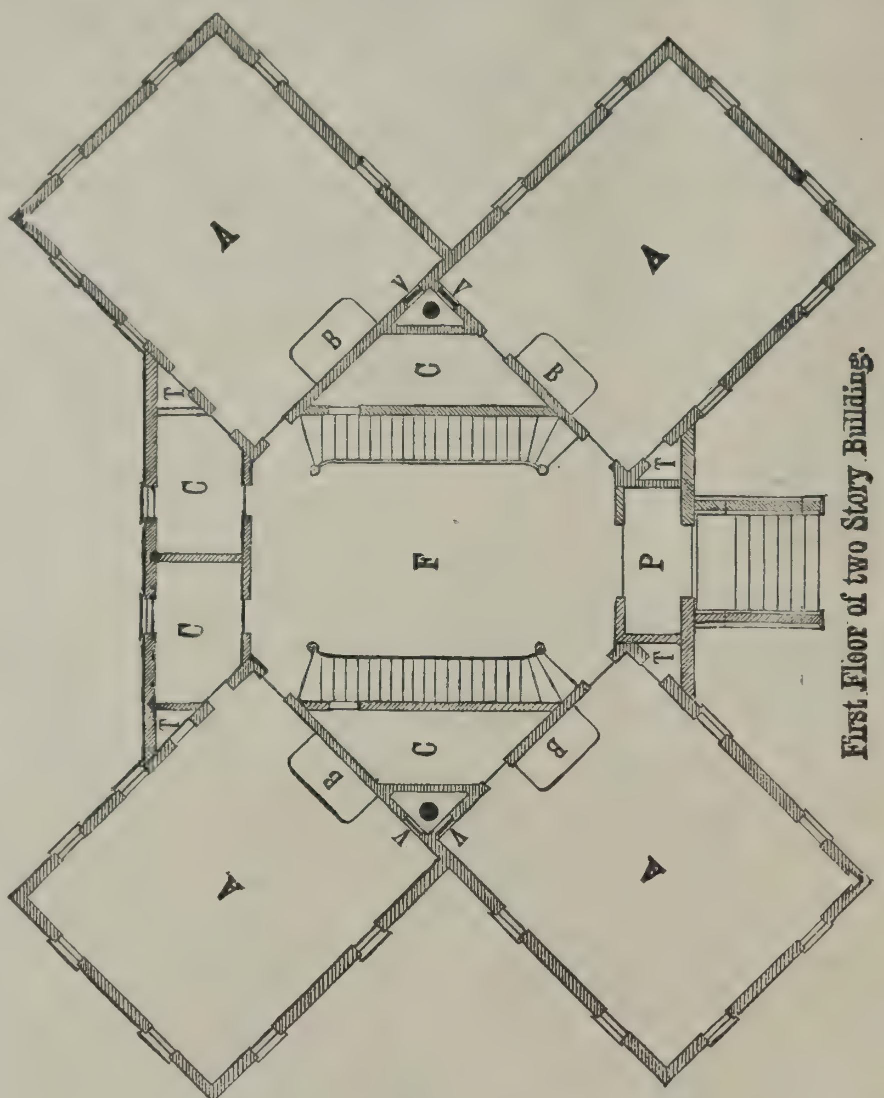
How to Make Duck Impervious to Water.

When duck is preferred to rubber cloth for the wagon covers, sides, and tops of business wagons, it can be made impervious to water, and yet be pliable and durable, by grinding 6 pounds of English ocher with boiled oil and adding 1 pound of black paint. An ounce of yellow soap, dissolved by heat in water, is mixed with the paint. This mixture is laid upon dry canvas as stiff as can conveniently be done with the brush. Two days after, a second coat of ocher and black paint (without any soap) is laid on; allowing this coat time to dry, the canvas is finished with a coat of any desired color.

NEW SCHOOLHOUSE DESIGN.

We present a diagram for the ground plan of a two story schoolhouse, and feel confident that it will be appreciated. Here are combined, at once, strength, beauty, and convenience. The injurious system of admitting light from only one side of the room is completely obviated by this plan. The light is here admitted just as it should be—from rows of windows arranged on either side. This arrangement of the windows furnishes also the best of facilities for ventilation. But perhaps one of the greatest advantages of this design is that the noise of one room can not annoy the others. When two rooms of a building are separated by only a thin partition, with a door opening through, the exercises of one are often very much disturbed by singing or concert recitation in the other. But by this plan each room will be as free from noise as though it stood entirely alone. Buildings of this design may be one, two, or three stories in height, according to the requirements of the district. For a village of from eight to ten hundred, the one story form will probably be sufficient. The two story house of this pattern will be well adapted to the wants of cities of from 1,500 to 2 000 inhabitants. The broken surface of this style of architecture adds greatly to the apparent size of the building, and the general appearance is much more pleasing than the plain outline of the rectangular form.

This design is not a mere experiment on the part of the architect, but is the outgrowth of forty years of careful study, aided by the suggestions of some of the best educators in the land. It is the work of Mr F. Langdon, of Winona, Minn.—*Iowa Normal Monthly.*



A, Schoolroom. B, Platform. T, Teachers' Closets. C, Cloakroom. F, Corridor. P, Vestibule. V, Ventilator.

NEW SCHOOLHOUSE DESIGN.—DRAWN AND DESIGNED BY F. LANGDON, ARCHITECT, WINONA, MINN.

The Sense of Smell.

The sense of smell is composed of two parts—a physical and nervous. The Schneiderian mucous membrane is the physical portion; the first pair of olfactory nerves constitute the nervous portion. The Schneiderian mucous membrane (named in honor of Schneider, who first demonstrated that the nasal sections came f. om racimose glands in this membrane, and not from the brain, as was formerly supposed) lines the entire nasal cavities. The olfactory portion, with which we have to deal in the study of the sense of smell, is easily distinguished from the rest of the nasal passages; in man, the sheep, and the calf, it is yellow; in most other mammalia it is of a brownish tinge; it is softer and thicker than other portions of the nasal mucous membrane. In man the epithelium of the olfactory membrane is covered with vibrating cilia, which are absent in most quadrupeds; this difference of structure probably is one cause of the inferior acuteness of the sense of smell in man. The olfactory membrane is limited by a tolerably well-defined outline to the superior and middle turbinated bones and the upper part of the septum nasi. This portion only is capable of receiving odorous impressions.

The olfactory nerve or ganglia has three roots, the exact origins of which have not been definitely made out; the external root, which is of white matter, has been traced to the corpus striatum and optic thalamus anterior commissure, and some fibers to the convolutions of the island of Reil. The middle or gray root arises from the caruncula mammillaris in the anterior lobe. The inner root of white matter arises from the inner and back part of the anterior lobe, and is probably connected with the gyrus fornicatus. These coalesce and run forward to the cribriform plate of the ethmoid bone, where there is a bulbous enlargement, from which are sent down the showers of filaments going to the olfactory mucous membrane. These filaments divide and subdivide, forming microscopic plexuses in the substance of the olfactory membrane, and appear to terminate between the fusiform cells of that membrane. The olfactory membrane also receives filaments from the nasal branch of the fifth pair of nerves, and is in direct communication with the spheno palatine ganglion of the sympathetic. It seems probable that the sense of smell is due to the solution of the emanations from bodies in the fluid secreted by the racimose glands of the olfactory membrane, and in this condition coming in contact with the terminal filaments of the olfactory nerves produces a molecular change, either chemical or physiological, which change, when transmitted to the brain, gives rise to the sensation. As a general rule, the longer the olfactory membrane is exposed to a particular odor, the longer its effects continue; and in some cases it may be perceived for quite a while after the odoriferous substance has been removed. A person once having perceived a certain scent will sometimes recognize the same odor (even though he may have forgotten it) without anything causing an idea of it, save perhaps an irritation of the ganglion. This ganglion is situated, according to Ferrier, in the temporo-sphenoidal convolutions, and is by him regarded as the psychological center of the sense of smell—*Medical Bulletin.*

COTTAGE LODGE.

This design is by Mr. Henry Shaw, architect, of 25 New Broad Street, London. The construction of the building has been kept as simple as possible, the walls being of red brick, and the upper portions being constructed in half-timber work, as shown.

PROPOSED · NEW · LODGE : RECREATION · GROUNDS · SYDENHAM · DESIGN · PLACED · SECOND · IN · COMPETITION. Henry Shaw · ARCHITECT

A Remarkable Iron Roof.

The great iron roof of the National Agricultural Hall at Kensington, designed by Mr. Am Ende and Mr. Walmisley, which is now in process of erection, will be one of the most remarkable constructions of the kind. The whole width of the hall is 250 ft., of which 40 ft. on each side are occupied by the aisles with low roofs, and the semicircular roof over the center space has a span of 170 ft. The principals are semicircular lattice ribs of 7 ft. depth, springing from cast-iron columns, which are treated on a new method, the connection with the principal at the head, and with the base plate, being made by a ball and socket bearing, so that the column will have free play in regard to any expansion and contraction of the roof. The abutment for the principals, which are, in reality, iron arches rather than girders, is formed by the framing of the iron trussing forming the constructive portion of the side aisles, which is again based on a subterranean truss bolted to the base plate of the column, and carried down into a deep trench across the width of the side aisle, which will be filled up with concrete in a solid mass surrounding the iron truss or subterranean cantilever, as it may be termed. The roof is entirely independent of the brick walls, which are mere inclosures. The first of the arched principals is nearly complete now. An immense traveling stage, comprising 1,0 0 cubic ft. of timber, has been erected, wide enough to take two principals (34 ft. apart), and high enough to admit of the manipulation of the upper sections of the principals by a traveling crane on the top of the staging. Considering the great span, the roof is wonderfully light in appearance; the strain on every member has been carefully calculated so as to avoid any unnecessary "margin," and the result is a roof which will be exceedingly strong and stable without any appearance of massiveness.

Boxwood.

It appears that, in consequence of the continued increased cost of boxwood and its rapid decrease in quality, one of the principal importers of this and other hard woods into this country has succeeded in introducing two American woods to be used instead of box in the manufacture of shuttles, a purpose for which immense quantities of boxwood have hitherto been used. The woods so substituted are those of the cornel and persimmon. The first is apparently the *Cornus florida*, a deciduous tree, about 30 ft. high, growing abundantly in woods in various parts of North America. The wood, though of small size, is hard, heavy, and close grained, and is used chiefly in America for the handles of tools and for shuttle making, and, when properly seasoned, is much superior to Persian boxwood. The same may be said of the persimmon (*Diospyros virginiana*), a tree belonging to the ebony family, a native of the United States, where it grows to a height of from 50 ft. to 60 ft and a diameter of a foot or 18 in. The heartwood is of a dark brown color, and very hard. The trunk is covered with a very thick, hard, and rugged bark. One great point to be particularly remembered in the preparation of these woods for shuttle making is the very gradual drying by artificial means; this is more particularly recommended in the case of the cornel, undue haste in seasoning, it is said, having in some cases created a prejudice against the wood. As an illustration to some extent of the effects of the war, it may be stated that while in 1876 over 10,000 tons of boxwood were imported, the year just passed shows a return of only between 4,000 and 5,000 tons. A large proportion of this wood is the produce of the forests on the Caspian Sea. Though the supply from the Black Sea provinces has for some years past been decreasing, it is well known that untouched forests of the wood exist in Russian territory, and it is hoped and expected that at the close of the present disastrous war these forests may be opened up, so that we may get abundant supplies of good wood for some time to come —*Journal of the Society of Arts.*

Products from a Small Garden.

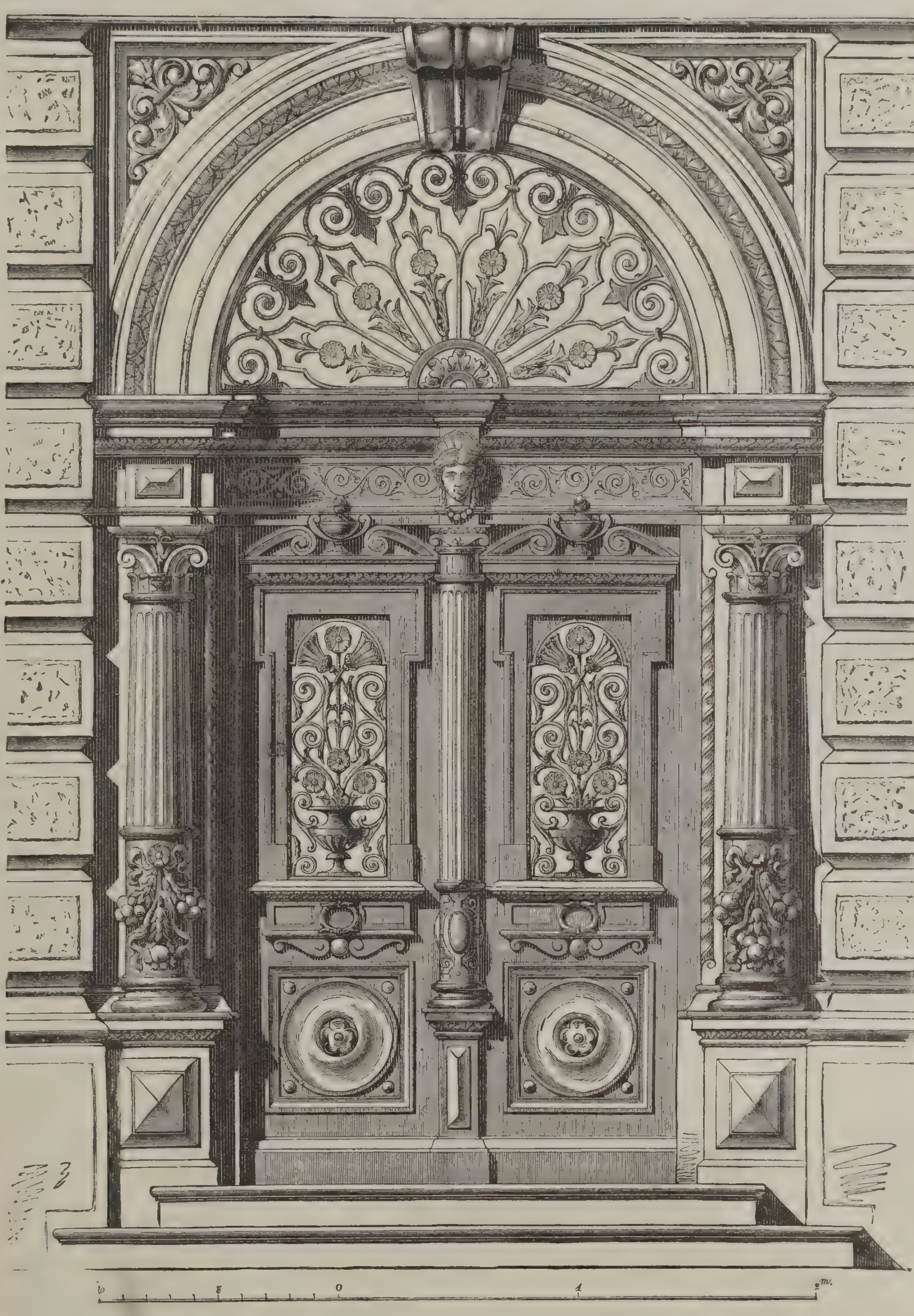
There are both profit and pleasure in the care of a good garden, as many readers of the *Farmer* know by experience. Too many, however, neglect this most important department of rural industry, and especially large farmers, who often feel that garden work is too small business, and rather beneath their notice. The old fashioned garden, occupying the same spot year after year, perhaps generation after generation, with its fence of stone, its row of currant bushes at one side, an asparagus bed in one corner, a few perennial herbs and a bunch of "pinies" in another, and weeds, both perennial and annual, by the million everywhere, the beets, the parsnips, and other fine stuff planted in raised beds, was a sorry sight generally, and enough to discourage either the hired man who worked in it before breakfast and at other odd moments, or the owner who paid the bills, and took the responsibility.

Old gardens often get more foul with weeds than any other part of the farm, while the narrow quarters make the work unneccessarily expensive. A farmer's garden should, or well may be, often changed to various places on the farm, not too distant to reach for gathering the products. The rows should be long, and in the main far enough apart for horse cultivation. Beds should be generally discarded. The kitchen garden and fruit garden, or orchard, should be as distinct as practicable, for few crops do well under the shade of fruit or ornamental trees.

The farmer can grow sweet corn in the field as cheaply as he can grow other corn, and the beet, the carrot, and the parsnip as well in the field as in the garden. Just what crops to grow is a question to be decided partly in accordance with the taste of the several members of the family, yet many persons who restrict themselves to a limited variety would geatly enjoy a wider range or selection, if the habit were only formed. In localities near large markets, it may sometimes be advisable to give attention to some few crops best adapted to one's own soil or locality, and buy others from those who can grow them in a large way more economically. But let it be distinctly understood that such garden vegetables as green peas, sweet corn, string beans, lettuce, cucumbers, and many others can never be bought in market that will compare with such vegatables taken from one's own garden, which find their way to the table within thirty minutes from the time they were picked. Some of the most profitable gardens we have ever seen have been the gardens of mechanics or mill operatives who have only their morning and evening hours for working in them. Many professional men living in villages have most excellent gardens, from which a large portion of their living is obtained.

We have just been handed the account a village neighbor has kept with his garden the past three years. It contains nearly thirty-seven rods or 10,000 square feet, one-fifth the area being thickly set with fruit trees which are of bearing age. The land was purchased in May, was in sod, rough and tough, and in poor condition for a garden the first year. The cash expended for seed, manure, and labor during the summer amounted to about $33. The crops grown the first year would have cost the owner not less than $50. The past two years the average product has been: three barrels Roxbury russet apples, twelve bushels pears, eight bushels string and shell beans, one bushel green peas, one bushel beets, five bushels tomatoes, one-half bushel onions, twenty bushels potatoes, three dozen summer squashes, ten dozen cucumbers, twenty-three dozen ears sweet corn, forty pounds winter squash, thirty-five boxes strawberries, eight quarts currants, besides a considerable quantity of blackberries and raspberries. Lettuce was also grown in abundance, and there is a young asparagus bed large enough to supply a moderate sized family. Most of the labor of planting and cultivation is hired at higher prices than farmers pay for labor in the country, which makes the products cost more than they should cost farmers. But then if he had purchased his vegetables and fruits in the market, he would not only have been charged the cost of raising, but also a large profit by the retailer. His family have spent some time in gathering the products, but it has been attended with the satisfaction of knowing that they are fresh and wholesome; and when the strawberries come to the table, they are free from suspicion as to cleanliness.

Very few farmers have garden vegetables and fruits as fine in appearance or in as great variety as they may be found in the large city markets, yet very few city people can obtain those things in as fine and choice condition as the farmer or country resident might have them if he was so disposed. We all ought to give more attention to the kitchen and fruit garden. There is money, health, and a great deal of satisfaction in a really good garden.—*N. E. Farmer.*



ORNAMENTAL DOORWAY.—DESIGNED BY PROF. V. MYSKOVSZKY, KASCHAU.

Cheap Method of Heating Factories.

It frequently happens that chimneys are now built round, without corners to retard the draught. This is done by inserting in the chimney, as the building progresses, cores consisting of iron pipes cast in sections, or tile piping. Air spaces are thus left between the core of the chimney and the outer wall, and of course the air in this space becomes heated to a high temperature. It is quite practical to utilize this air for heating purposes, if this is found desirable. The air spaces being closed at the top, and openings being made to the open air at the base of the chimney, tin piping is connected with the spaces for conducting the heat to different parts of the factory. Of course, this method is not designed for heating the stories nearest the ground, as the current of air in ascending has not had sufficient exposure to become heated until it has reached the third or fourth story of the building.

LINCRUSTA-WALTON.

Several stores in New York, Boston, and St. Louis have been decorated with Lincrusta-Walton, and are marvels of beauty. One recently fitted by Mr. Conkling, at the corner of Broadway and 31st Street, may be inspected as showing what can be done with this material. Mr Conkling was his own architect and designer in this instance, and has finished the decoration in dull black, having the appearance of carved ebony. This, contrasting with the polished brass ornamentation, gives a delightful and really artistic effect. It is flattering to Mr. Conkling to find that he has been asked to advise in decorating many other stores with Lincrusta. In this instance about twenty patterns of Lincrusta-Walton were employed.

Figure 1 is a two-band border reduced to ¼ of the original size. It is a quaint design, and capable of very pretty ornamentation. Figure 2 represents a hanging or filling. If decorated in the color of mahogany, it cannot be distinguished from that material. The panels and rosettes in relief are sharp in their outlines, and have all the character of carved wood. Messrs. Fr. Beck & Co., the manufacturers of Lincrusta-Walton, are just publishing a supplementary book of designs.

Fig. 1.—LINCRUSTA-WALTON—TWO-BAND BORDER. (Scale ¼ of original.)

Fig. 2.—LINCRUSTA-WALTON HANGING OR FILLING. (Scale ¼ of original.)

Smoke Testing of Drains.

Cosmo Innes, the Secretary of the London Sanitary Protection Association, writes to the *Journal of the Society of Arts*, suggesting a smoke test, instead of that of some strong volatile liquid, for detecting defects in sewer pipes, as the smoke test will be apparent to the eye as well as the nose. That such testing may be done cheaply, he has devised a style of smoke rocket, charged so as to burn for ten minutes; the fuse is to be lighted and the rocket inserted in the drain with a plug behind it, when the observer is to walk through the house to see if any smoke escapes, finishing on the roof, where the smoke will come in volumes from the ventilating pipe. If it is desired to increase the severity of the test, a wet blanket may be thrown over the top of the ventilating pipe, giving a slight pressure of smoke inside. As sanitary inspectors everywhere have especial reasons for being extremely vigilant during the coming year, this method of testing pipes and drains may prove valuable in many instances where it is not convenient to apply other tests.

On the Coagulation of Blood.*

Brucke's researches on the conditions of coagulation of blood have shown that, on the one hand, contact with foreign bodies makes blood coagulate, and, on the other, that contact on all sides with the fresh vascular wall obviates coagulation (Durante). Lacker has proved the influence of foreign bodies on blood coagulation by microscopic observation of coagulation in its first stages. In partial contradiction to these results was the observation of Grunhagen that blood, when received into glycerine, and so long as it did not mix, remained liquid. To determine the nature of these influences the following experiments were made. Blood was drawn under oil from the carotid artery of a dog, and let stand at ordinary indoor temperature; after twenty-four hours it was *not* coagulated. Then the blood was drawn into a vessel smeared inside with vaseline, and it too *did not coagulate*. When it was stirred with an oiled glass rod, no fibrine was separated; but when, even after several hours, part of this blood was poured into an ungreased vessel, it coagulated in a few minutes. Moreover, contact with an ungreased glass rod sufficed to make the blood in the greased vessel coagulate outward from the rod.

Further experiments showed that the drying of the upper layers of the blood, and the presence of small quantities of dust, caused coagulation even in the greased vessel; if this was guarded against, the blood remained liquid for days, and the corpuscles sank to the bottom, the plasma remaining as a clear liquid above.

After pouring out the blood, the greased walls of the glass vessel showed neither blood coloring matters nor traces of a separated albuminous body. A repetition of these experiments at 37° C. gave the same result. In all the experiments blood was also, for comparison, drawn off into ungreased vessels, and in all these it coagulated, at the most, in a quarter of an hour.

In further experiments a small vaseline-lined glass tube was used as a canula; and the blood drawn through this into vaseline-lined vessels also remained uncoagulated.

When the outer orifice of a canula inserted in the carotid was closed, the blood column in it pulsated, without showing the least sign of coagulation even after two hours.

In all these experiments there was nowhere in the vessels with which the blood came into contact even a point for adhesion—such a point would have caused in shorter or longer time coagulation of the whole mass of blood. Thus the coagulative influence of foreign bodies appears to be due to their adhesion.

But to demonstrate that the anti-coagulative property of the vascular walls is due to the lack of adhesion, a further series of experiments was made with soaked fish bladders and parchment tubes.

The membranes lay several hours in 0·6 per cent chloride of sodium solution; the blood was drawn off through a vaseline-lined canula into the bladders and tubes, which were then so hung in a liter of the salt solution that the mass of blood was under the surface. In these experiments also the blood remained liquid, the surrounding salt solution having no cogulative effect, while some of the blood, poured after twenty-four hours into an ungreased porcelain vessel for comparison, soon coagulated. Like the blood vessels, which, unlike manufactured vessels, after being emptied of the blood, retain no coloring matter, the membranes, even after several days, showed neither imbibition with blood-coloring matter nor any trace of coagulated fibrine. Thus, by soaking in salt solution, a property of the blood vessels was imparted to the fish bladders and parchment tubes.

It can hardly be doubted, then, that while, on the one hand, lack of adhesion prevents blood from coagulating, so, on the other, the presence of adhesion gives the impulse to coagulation.—*Nature.*

* By Ernest Freund, in *Wiener Medicinische Jahrbucher*, 1886, Heft 1.

The Mullein Plant.

A good deal has been written lately about the mullein plant, and its efficiency as a cure for consumption. In reference to the use of the above, Dr. Quinlan, of Dublin, writes to the *British Medical Journal* that 3 oz. of the green leaves should be boiled for ten minutes in a pint of new milk. The liquid is then strained, sweetened to taste, and drunk while warm. This dose can be repeated twice or three times a day. This high authority has no doubt of its efficacy as a curative in the earlier and a palliative in the later stages of pulmonary consumption. Care should be taken to use the leaves of the great mullein, known by its thick, mucilaginous, and woolly leaves.

Prize for the Best Method of Preventing Blasting Accidents in Coal Mines.

The mining owners of Ostraw Rarwin have decided to offer a prize of 1,000 ducats (about $2,500) for the best invention for preventing accidents in the shooting and ballasting connected with coal dust in mines, or rendering the operation harmless. The invention should answer to the following conditions, namely: 1st. Its use, effects, or explosion should not cause the coal dust to ignite. 2d. It should not produce after the explosion or use more injurious gas than through the methods heretofore employed. 3d. No specially difficult, dangerous, long preliminary arrangements or complicated apparatus should be required in using, setting up, loading, transporting, or lighting. 4th. Should not by its use and result be much more expensive than the former blasting methods. All applications should contain full particulars, and also of practical tests already made, stating name and address of applicant, and be sent on or before the end of 1886 to the K. K. Berghauptmannschaft, at Vienna. All projects, also the one which will be awarded the prize, will remain the property of the inventor. From the Imperial Royal Ministry of Agriculture, Vienna.

A PATENT has been granted in Russia for a lucifer match that can be used an indefinite number of times.

Arsenic in Wall Paper.

The annual excitement in the city of Boston relating to the presence of arsenic in wall paper has, on this occasion, resulted in thorough investigation by a committee of the Massachusetts Legislature, so that the medical profession and the public at large have at length the plain facts before them.

One of the questions investigated was the manner in which the poison was communicated, supposing arsenic to be present in the wall paper in any quantity. Of course, there are two ways in which this could happen: First, by *attrition* or friction, where the color containing the arsenic is rubbed off. This would most probably occur in a bedroom where the bed was placed next to a wall, as the movement of the bed clothes against the wall would produce such an effect. It is obvious, however, that only a very small percentage of the arsenic on the walls could be removed within a certain amount of time; and, unless the walls were literally covered with arsenic, it would be difficult for a person during the night to collect sufficient of the poison to produce toxic symptoms.

The case, however, assumes very different proportions if the arsenic present could be shown to be decomposed and mixed with the air of the room in the form of a gas. A very small proportion of arsenic breathed as arseniureted hydrogen would cause immediate sickness. It is therefore clear that this form of arsenical poisoning is to be most dreaded.

The legislative committee tried to clear up this point: whether arsenic could, or could not, be converted into arseniureted hydrogen gas in a room by damp or any other cause.

The evidence of Prof. C. F. Chandler, of New York, before the committee was very convincing as showing that this danger did not exist. It appears that some time ago, as a mere scientific experiment at Columbia College, he tested this matter in the most severe manner. He prepared a large box to represent a room, and hung the interior with a wall paper full of Paris green. The paper was hung in deep folds dropping from top to bottom of the box; new paste was added to represent the actual conditions and afford the necessary dampness to produce the gas. Air was forced through the box for some time and collected, and afterward analyzed. On all occasions not a trace of arseniureted hydrogen could be found. On the strength of these and other tests, Prof. Chandler gave his opinion, that under no conditions could arsenical poisoning occur through breathing arseniureted hydrogen from wall paper, leaving the only risk that could happen to be from friction alone.

As to the question of arsenic in wall paper, it was admitted that there was a time when it was used without limit as a coloring material, but three years ago it was practically abandoned; since this time arsenic has undoubtedly been present in small quantities, even when the color has been sold and guaranteed to be non-arsenical. This may have arisen from the presence of arsenic in the zinc or other ingredients of the color, as a simple impurity; but for all practical purposes, it may be stated that the use of arsenical colors has been abandoned by reputable manufacturers.

The bill before the Massachusetts Legislature proposes to place a limit to the presence of arsenic in wall paper at one-fourteenth of a grain to the square yard, which is about half a grain to the piece of eight yards. Since the opening of the investigation, it has been found that arsenic is present in large quantities in the paper of fancy boxes, paper for wrapping candy, gentlemen's underwear, carpets, ladies' dresses, and a variety of other articles of general commerce. It is now proposed very justly to make this anti arsenic bill apply to manufacturers generally.

As to the question of legislating on this subject, Professor Chandler said that one grain to the square yard would be a safe limit, but he was opposed to any restrictive measure, because he thought the danger had passed, and did not at the present time exist. Such a bill would cause unnecessary alarm in the public mind, and create a prejudice; it would also cause trouble to the manufacturers, leading to endless litigation and disputes. If, however, any restrictive bill of this kind is passed by the Massachusetts Legislature, it should certainly apply to all kinds of manufactures, particularly to clothing and articles coming in contact with food products.—*Medical Record.*

Rum Blossoms.

A correspondent of the *American Analyst* asks: "What is the cause of redness and pimples on the nose?" and receives the following answer: "Judging from the liquor saloon heading of your note and the *nom de plume* you have chosen, it is fair to presume that in your case rum is the cause, and medical men would call your disease dipsomania and the skin disease acne, while in common parlance it is called 'rum blossoms.' The explanation is very simple. The circulation is through two sets of blood vessels, arteries, and veins, both obtaining their motive power from the heart acting as a force pump. Alcohol increases the pulsations, and as the blood is sent from the heart to the extremities faster than the veins can take it up again to return it, congestion results, and the nose, being at a remote po rtion of he circulation, reddens and finally becomes diseased. This, however, is not different from other organs of the body; all are congested and similarly diseased by alcohol. The best remedy is to discontinue the alcohol, and stimulate the absorption of the blood by the frequent application of cloths wrung out of hot water."

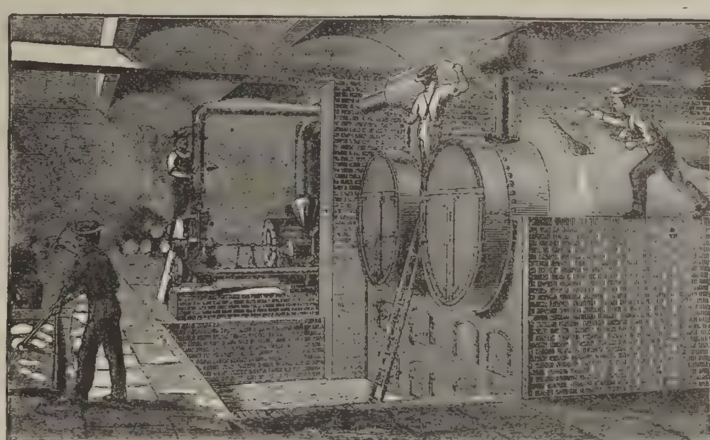
ASBESTOS CEMENT FELTING.

We give two illustrations this month showing how Asbestos Cement Felting is applied both to locomotives and stationary boilers.

Experience has proved that it is impossible to run a locomotive with any satisfactory results without some protection to the boiler. The loss of steam consequent on the exposure of the boiler to the wind and weather cannot be remedied even with the free use of fuel. Wood lagging has long been the favorite method of jacketing; but since the introduction of asbestos cement felting, the results effected by its use have been so superior to the ordinary wood lagging, not only in durability, but in its greater effectiveness as a non-conductor, that the superintendents and master mechanics of many of the leading railroads are using it entirely. It cannot char, and when properly applied it will not crack. A leak anywhere is readily exposed where it occurs, and a section can be cut out and then replaced after the leak has been repaired.

ASBESTOS CEMENT FELTING APPLIED TO LOCOMOTIVES.

For stationary boilers, steam pipes, and other heated surfaces, the use of some protection has come to be generally recognized as a necessity, if the economical use of fuel and the advantages of dry steam are considered. In this age of invention, almost all substances having any merits at all as non-conductors have been applied in one way or another as steam pipe coverings. Asbestos, from its fire-proof nature, used in connection with the best of other non-conductors in the form of a cement felting, possesses superior advantages as a protection for heated surfaces. It can be applied readily when the surface to be protected is either hot or cold, and when desirable can be removed and replaced again, and a leak can be easily detected through the covering. It is light, indestructible, and fire-proof, and for exposed surfaces out of doors it effectually resists the action of the weather in any climate, while for underground pipes it can be applied with boxing, even though the ground be continually moist or wet. It cannot decay.



COVERING STEAM BOILERS AND PIPES WITH ASBESTOS CEMENT FELTING.

The use of asbestos cement felting is not confined to the protection of heated surfaces, steam pipes, boilers, etc., but used in connection with wire lathing as a plaster, it has no superior. For fire-proofing boiler or engine rooms where the asbestos flooring felt before referred to cannot be used to advantage, it is of great service. The advantages of its use as a lining for safes are of course apparent at once.

This asbestos cement felting is manufactured by the Asbestos Packing Co., 169 Congress St., Boston, and 33 John St., New York. The company issues a handsome pamphlet, which will well repay examination.

Lime in a Water Pipe.

Mr. W. F. Kearney sends to the *Sanitary News* a piece of wrought iron pipe about six inches long and one inch internal diameter, containing a lime deposit. The coating on the interior is so thick that an orifice is left only about the size of a lead pencil, and its inner surface hard and glossy, the result of use in the kitchen range of a hotel (Hubbard) from March 12, 1886, until April 3, or about twenty days. I have several times replaced the pipes, which fil up with lime, as in the present case.

The city supply is derived from two hundred well points, driven thirty feet from surface, and all connected to Holly pump, which forces water to a reservoir located on the highest of the surrounding hills. This avoids the necessity of keeping pumps going nights.

Owing to the elevation of the reservoir, the pressure in the street mains in the business portion of the city is 108 pounds. The water is clear as a crystal, palatable, but rather hard.

The city ordinance requiring the laying of lead pipe for house service went into effect April 1. Previous to that time, galvanized iron pipe was used. The city, contemplating paving the streets, will, in the future, use only the best, thus avoiding frequent tearing up of streets, caused by the breaking pipes.

The city authorities are endeavoring to start right and secure only good plumbing; but as licenses are given to all persons securing a \$2,000 bond, it has resulted in several parties not plumbers carrying on a plumbing business. The master plumbers' association of Iowa might, with propriety, look into the matter.

Ventilation.

According to a lecture recently delivered by Mr. J. B. Gass before the Royal Institute of British Architects, at the Massachusetts Institute of Technology, Boston, there is under the whole of the basement of the building a *plenum*, 3 feet 6 inches high, into which fresh air, warmed or not as required, is pumped under a pressure of one-eighth inch of water. From this great reservoir of fresh air, flues lead to the different rooms. The flues are 36 inches by 12 inches, with a steam coil box at the bottom of each; the temperature and volume of air in every flue being entirely under the control of the engine driver. The air is admitted into the rooms through openings 8 feet above the floor line, and larger in area than the flue, so as to secure slow movements of the inflowing current. The outlet flues have two apertures in the room—one a few inches from the floor, and the other close to the ceiling; the former being alone used during the time the rooms are occupied by the classes. These flues discharge into outlets above the roof. The outlets are smaller than the inlets, so as to give pressure against the outside, and prevent draughts.

The whole system is under the control of the attendant who drives the ventilating fan, and who is responsible for maintaining a temperature of 65° Fah. in the classrooms. The attendant is furnished every evening with the weather prediction for the ensuing day; and he makes his arrangements according to precise instructions tabulated for different climatic conditions. Mr. Gass says that this system is both successful and economical in working. No special precaution appears to be taken with respect to the point of intake of the air in the first place; but at other establishments where aerial sanitation is much regarded, the air is taken from the top of a tower, warmed or cooled as may be required, washed, and filtered before being introduced into the rooms.

Roofing Paint.

Sparham's roofing is said to be composed of soapstone, mica, and plumbago, ground rather fine. These ingredients are mixed with tar, and are applied over felt in place of gravel and pitch. The tar used with this cement is coal tar, not boiled; it, therefore, is not liable to crack like gravel roofs. The mixture is applied, two-thirds cement and one-third tar, with a trowel, one-eighth to one-quarter of an inch in thickness.

This mixture unites, and forms a substance like rubber, and a resistance to water, cold, and heat. When properly mixed as stiff mortar, can be applied to roofs that have a pitch of from one-half inch to three inches to the foot, and will not run in summer weather, nor crack in winter; is water-proof. Mixed thin and applied like paint on wooden battlements or other woodwork, will preserve the wood, and can be applied to tin or zinc roofs, preventing rust and stopping leaks when properly applied.

To Restore Gloss to a Silk Hat.

When a silk hat becomes wet, or, from other causes, has lost its smoothness and gloss, cleanse it carefully from all dust, then with an old silk handkerchief apply vaseline evenly, and smooth down with the same rag until it is dry, smooth, and glossy. This will make an old hat look about as good as new.

PERILLE'S SAFETY CATCH.

The apparatus herewith illustrated is designed to act as a substitute for the ordinary door bolt and safety chain. It permits of entirely closing a door, or of opening it on a crack to see who the visitor is, receive a letter, etc., from him, without allowing him to enter in case his presence is not desirable.

In Fig. 1 the apparatus is shown unfastened, and the door can be freely opened. In Fig. 2 the catch is placed at right angles with the plane of the door, and, forming a strong bolt, the door cannot be opened. In Fig.

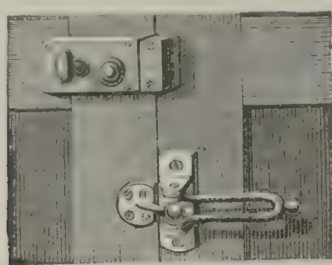


Fig. 1.—The Catch Open.

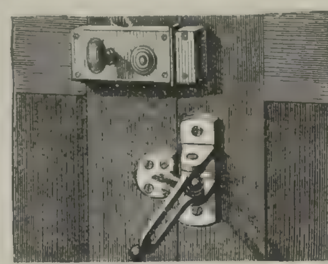
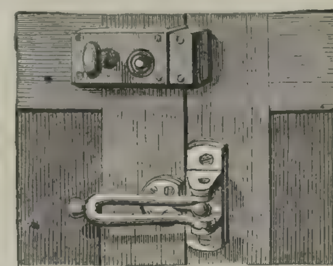
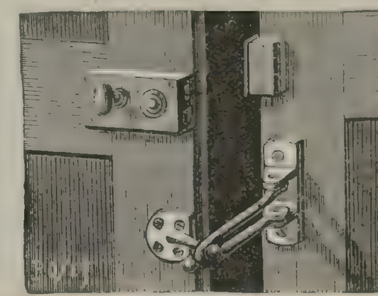


Fig. 2.—The Same Forming a Bolt.



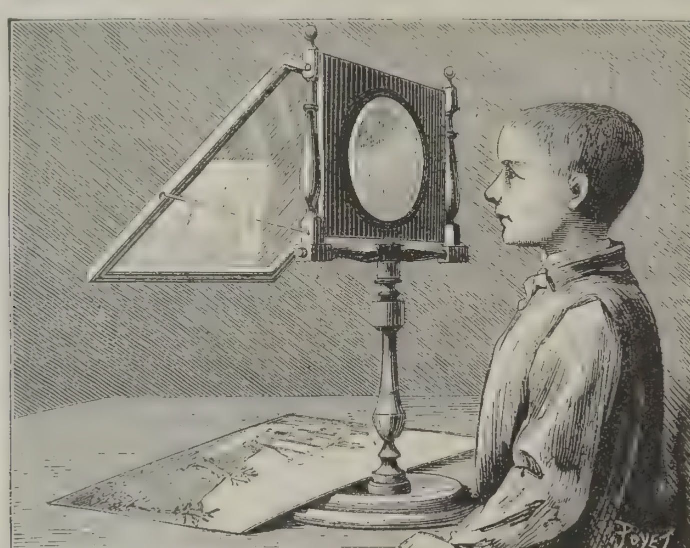


Figs. 3 and 4.—The Same as a Safety Chain.

PERILLE'S SAFETY CATCH.

3 it is turned sidewise so as to form a safety chain. In this case the door can be partially opened, but only the length of the catch, as shown in Fig. 4. It is impossible to force a passage, but there is room enough to admit the hand.

Our engravings allow the mechanism to be well enough understood without the necessity of a long description. The door is provided with a steel rod terminating in a knob which slides between the arms of the catch fixed to the jambs. In the closed position (Fig. 2) the knob is held by the arms of the catch, which are too close together to give it passage. The catch must be pushed to one side in order that the fixed rod shall



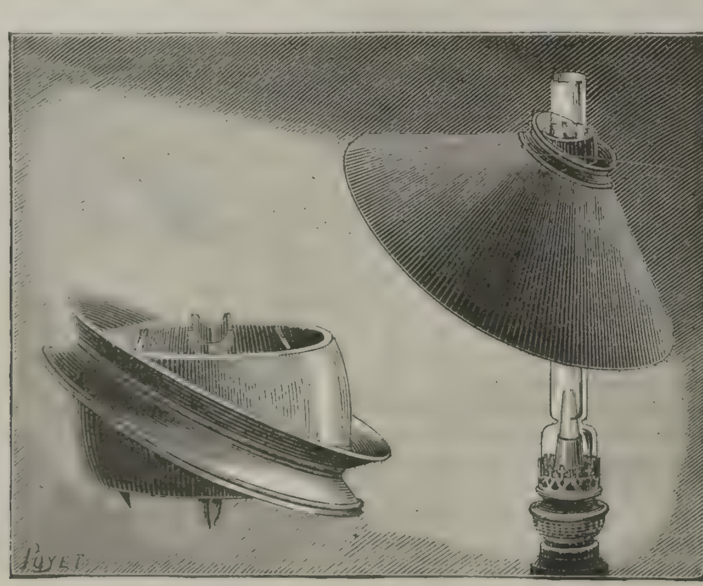
APPARATUS FOR EXAMINING ENGRAVINGS.

slide in it—the knob then being outside, as shown in Fig. 4.

This catch is of nickelized steel, and is very neat in appearance. It will be found very useful for front doors. The two parts of the apparatus are fixed to the wood of the door and jambs by large screws, and it would be impossible for thieves to force it off with nippers, as they do ordinary locks.

A NEW LAMP SHADE.

When a lamp is provided with an ordinary shade, it is necessary to remove the latter whenever it is desired to illuminate any other spot in a room other than the



A NEW LAMP SHADE.

surface of the table upon which the lamp stands. Mr. Bara, an engineer, has recently devised a very practical system that permits of inclining the shade in any direction whatever, as shown in the accompanying figure. This spherically rotating shade is very convenient, and we recommend it to our readers.

The apparatus, which is interesting in itself, is likewise curious by reason of the peculiar mode of manufacture that it necessitates. The piece with a spherical surface that supports the shade presented difficulties in the way of construction that have been overcome by Mr. Lieux, the manufacturer, in the following way: A thin metallic cylinder is placed in a steel mould of the desired spherical form. A rubber plug is introduced into the cylinder, so as to fill it. This done, the elastic plug is strongly compressed by means of a stamping press analogous to those that are used for coining money. The pressure upon the metallic cylinder causes it to take the spherical form of the steel mould. The other parts of the shade are made by the ordinary processes. Our figure so well shows the arrangement and mounting that it is unnecessary to dwell longer upon this useful improvement of a small household article.

APPARATUS FOR EXAMINING ENGRAVINGS.

Amateurs of prints know that there exists a large number of engravings whose title is printed in reversed letters that cannot be read directly, but only by being reflected from a mirror. One of our readers has asked for an explamation of this fact, and the subject has seemed to us of sufficient general interest to be treated of in this place. These (usually colored) engravings with reversed letters constitute what our fathers called "optical views." They were examined by means of an apparatus that was in reality a sort of monostereoscope with a large lens. We reproduce the apparatus herewith from an old model. The engraving was laid flat upon the table with the top turned toward the observer, who, looking through a large concavo-concave lens, saw an enlarged and right-side up image of the engraving, owing to a mirror inclined 45°, as shown in the figure. The engraving appears vertical in the apparatus, its title becomes readable, and the subjects represented have a remarkable semblance of relief. This old apparatus can be very easily constructed, and is very useful for examining engravings, drawings, and aquarelles.

Dakota farmers are making plans to grow flax for fuel this summer. It is said that a ton of flax straw is worth more to burn than a ton of soft coal.

CORK CLOTH.

Mr. William Jackson, director of the Bureau of Equipments for the Army and Navy, in Victoria Street, London, is the inventor of a cloth of which the weft is of cork fiber cut from the bark by a special tool. The warp is of wool, silk, linen, or hemp, according to circumstances. As the cork fiber easily retains the dye employed for the textile with which it is associated, there is nothing in the appearance of this new fabric to distinguish it from the cloth employed for the overcoats of navy officers, sailors, and passengers. Clothes made from it are as convenient, and supple, and almost as light as ordinary garments; and, moreover, they possess the valuable property of sustaining their wearers without the latter having need to make the least motion on the surface of the water. The material may be used for making bathing suits, which are as flexible as the cotton ones furnished at the seaside, which adapt themselves to all the motions of swimming, and by means of which a person may venture as far as he chooses. Numerous experiments were performed last August on the Isle of Wight and in the Thames under the eyes of the Lord Mayor; and cork garments have likewise been tried in swimming baths at London and Ryde, and in

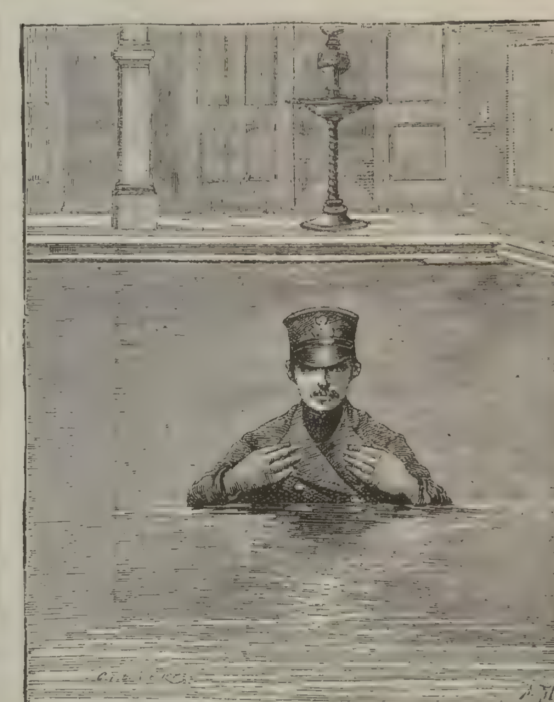


Fig. 1.—ENGLISH SOLDIER CLOTHED IN CORK CLOTH.

the great piscina of Rochechouart Street. In the Isle of Wight experiments, six persons (three of them ladies who did not know how to swim) jumped into the sea together, and floated for more than an hour in the presence of an immense crowd, which warmly applauded these new sirens and tritons.

The facility with which the properties of cork cloth have been utilized to produce this happy result will be readily understood when we state that a piece measuring $3\frac{1}{2} \times 2\frac{1}{4}$ inches has supported a weight of 180 grains after being first saturated with water. These figures show that a piece having a superficies of one yard would sustain about four and a quarter pounds. It may be admitted that it requires but slight effort to

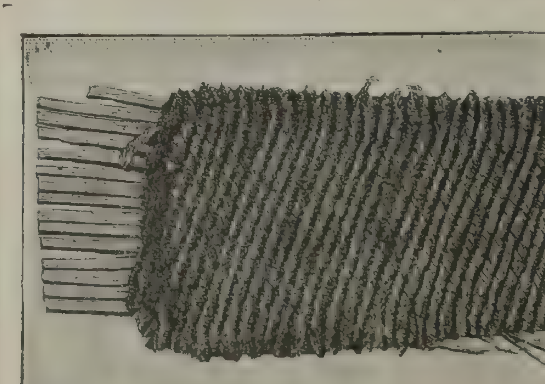


Fig. 2.—TEXTURE OF CORK CLOTH.

support a lean man above the surface of the water, and as the density of cork is about a quarter that of water, it requires but a weight of about seventeen ounces to effect the result. As cork fiber here takes the place of a textile weft, it will be seen that these seventeen ounces are themselves far from representing the excess of weight over that of a cloth garment.

TIMBER: ITS GROWTH, SEASONING, AND PREPARATION FOR USE.*

By THOMAS BLASHILL.

THE first of a course of free lectures on matters connected with building, to be delivered at Carpenters' Hall, London Wall, E. C.

In his opening remarks Mr. Blashill referred to the fact that plants recognized as trees belong to two different classes—the endogenous specimens, in which the fresh matter is added in the center, and the exogenous trees, in which the increase was by coats of wood added on the outside of the stem. In the former class, of which palms were the best recognized illustrations, the center of the tree consists of pith, with an outer husk of bark. In the latter class, to which all our timber trees belonged, we easily recognized three distinct parts—the bark, the wood, and the pith. He would examine the growth of one of the latter class of trees as it appeared say half a century after it sprouted from a seed. The pith, at first a very distinct rod of white, spongy substance, afterward dried and shrunk, becoming partially dead. Outside was the wood in fifty rings, usually very easy to count. All, except a few of the outer rings, were comparatively hard and dry, of darker color than the rest, and practically dead also, because they had ceased to take part in the life of the tree. This was the heart now. Outside, it was one, perhaps three or four—perhaps two—rings of softer wood, full of sap, light in color, and, when carefully examined, considerably alive. Outside this sap-wood was the bark: first the inner bark—white, moist, living, consisting of many thin layers or rays. Finally, there was the outer bark, consisting of a layer containing such coloring matter as the stem might have, and an outer layer resembling the central pith; this might be thin, as in the birch, or thick, as in the cork oak. The lecturer next proceeded to inquire into the manner of growth of a tree with reference to the eventual effect of external and internal influences on the timber. Having alluded to the rise of the sap, the lecturer showed that this fed the thin layer between the inner bark and the last annular ring, so thickening it that, tightly as the bark inclosed the stem, it had to yield to the pressure. The bark consisted of reticulated fibers, which allowed of a certain amount of expansion, but the internal pressure also caused it to crack and peel in places in various ways, according to the thickness of the tree. It should be remembered that the stem was never quite correct, as the rings were never of the same thickness all round. They were generally thickest on the sunny side of the tree. If all the branches and roots were on one side of the tree, as when it stood at the edge of a wood, all the rings were enormously thickened on that side. In the Museum at Kew there was a section of a fir tree which measured from pith to bark on one side 13 in., and on the other side 4 ft., each ring being on an average four times thicker on the one side than on the other. The rings differed from each other also in thickness. As the tree developed fresh branches, the rings tended to get thicker. In a good season they were thickest, in a bad season decidedly thinner, so that a growing tree was a self-acting register of the weather as far as regarded its suitability for vegetation. In fact, we might count the rings back for centuries, and gain some generalization of the average summer weather of each year. When the sapwood was a few years old—say, from three to four years in chestnut, seven years and upward in oak—the sap ceased to flow in it, and it changed in a season to heartwood, but not quite uniformly. Two or three rings would often be turned to heartwood on the sunny side of the tree, while they remained full of sap on the opposite side. The heartwood became solid, and its pores were filled up with any gums or resins that the particular kind of tree produced. The heartwood underwent no further change until the tree grew old, when it was the first part of the wood to decay. The sapwood kept up a sort of growth within itself as long as it existed in that condition.

Another very important feature in the wood of all timber trees was that they produced plates of woody fiber that in the young plant connected the bark with the pith. These were known as "medullary plates." They were not visible to the naked eye, except in oak, beech, and some few other trees. They were very conspicuous in the end grain of oak. As the trunk increased in size fresh medullary plates start up midway between the older ones, and are kept growing at the junction of the sapwood and bark, and extend both toward the center and outer surface. The plates were only a few inches in depth up and down, but between them fresh ones started out, so that they overlapped each other. When we see them in the end grain showing as bright, fine lines, they were termed "medullary rays;" when seen sidewise in a split log, they were known as the "flower," or silver grain. Having exhibited specimens of oak showing these plates, the lecturer referred to the beauty they imparted to this wood, and mentioned that the plates could not be traced in the Spanish chestnut, ash, or elm. The medullary plates were not only ornamental, but very serviceable in oak timber. They added to the strength of the wood across the grain, so that the pins of oak tenons would not draw out. They were harder than the rest of the wood. In an oak slab which had seen many years' rough wear, say the sill in the ticket window of a railway-station on which the booking clerk dashed down his change, the silver graining stood up in ridges above the wood of the annual rings. They resisted shrinkage, decay, and worms, which would only bore through them in order to get at the softer wood beyond. A few things showed how the wood grew by annual layers. Let them suppose that three branches were removed from a tree, one being taken off close to the trunk, the second cut off with a few inches of projection, and the third left long enough to produce twigs and leaves. The new wood would, in a few weeks, grow over the first, leaving a wound in the wood called a bandgall. The second would have become a dead stump, owing to the absence of leaves, and would next be inclosed by the new wood. The third would continue alive because it had been able to develop leaves. Iron spikes driven into trees were often grown over. He exhibited a specimen of English walnut wood, lent him by Messrs. Broadwood, in which the head of a long iron, used to fasten wire fencing, had been covered over with 3 in. of new wood. For all uses of any importance timber should be taken from the heartwood of a sound, well-grown tree. The grain should be close and firm, and should sound well when struck. The annual rings should be of even thickness, and the grain straight. It should be free from large or dead knots, shakes and blemishes. The chief defects found in a log of timber, besides those already mentioned, were—(a) cupshakes, which were gaping openings, forming segments of circles between the annual rings; (b) starshakes, cracks that ran toward the center of the tree; and (c) heartshakes, that opened in the center of the tree and spread toward the bark. If a heartshake were straight across the butt and ran up the log in a perfectly straight direction, it did no harm; but if it wound so as to get crosswise, by the time it got to the other end, the log was spoilt for most purposes. This tendency of the trunks of trees to twist was very curious. Most trees were subject to it; the Spanish chestnut in our country, the worst in this respect, twisted so violently, that by the time the tree was 60 years old it was usually badly torn by shakes, and began to decay at the heart. The lecturer did not think that this peculiarity in growth had been explained; but there were some very interesting facts in connection with the development of trees that seemed to bear on the question. However quietly a young tree might appear to grow, there was really a constant strain existing within it. The center of the stem was straining to elongate itself; the outer parts were holding it back. These forces, as a rule, balanced each other, so that they could only be discovered by experiment. It was easy to excite the fibers of a young plant in one place so that it would, of its own force, bend considerably out of the upright. Besides this, although a stem seemed to be growing regularly, there was a tendency to grow first on one side and then on another, so that a movement was set up such as was most strongly developed in the hop. When the stem of a large tree twisted without being affected by violent winds, it was evident that one of these forces connected with its growth had got the better of the other forces, so that the balance was not perfectly preserved. On the other hand, a young tree that had grown crooked sometimes altered its habits so as to make new wood in a straight and regular manner. When that was so, we found in the center of that log the crooked wood of the young tree.

Mr. Blashill continued: We next come to the questions of felling and preparation for use. The best ages at which trees can be felled are: for oak, 100 to 200 years; Scotch pine and Norway spruce, 70 to 100; larch, ash, and elm, 50 to 100; poplar, 30 to 50. The best time of the year for felling is the winter, because the tree is then most free from sap. Some trees may be felled soon after midsummer, because the sap is very quiet at that time. Oak is generally felled in the early spring—the worst time possible—because the bark, which is very valuable, is best obtained when the tree is full of sap. It is better to strip the bark off as the tree stands in the spring, and to fell it in the following autumn, when the sap has dried out of it. Teak is barked three years before being felled. It shrinks less than any wood in ordinary use, but it is said that this method renders the wood of teak more brittle. We have seen that the trunk of the growing tree is composed of wood in very different conditions. The interior is hard, comparatively dry, perhaps having its pores filled with resin or gum. The outer rings of wood are softer as they come nearer the bark, fuller of sap, more actively alive. Seasoning is the gradual drying of the whole log so that the shrinkage of the outer part shall not be so rapid as to cause it to split and tear open before the interior has had time to part with its moisture. If timber is to be seasoned without artificial help, it should be stored over a dry surface free from vegetation, well packed off the ground, with free access of air, but not exposed to much wind. When squared it should be stored under cover to give shelter from rain, sun, and wind. So treated, oak will require as many months as the side of the log measures in inches. Fir will take half this time. The timber should then be cut into plank or large scantlings, and be still further exposed to the air, being so stacked that it cannot warp or twist. When it is cut to the sizes for which it is required to be used, it is again stacked till it becomes fully seasoned. Finally, it should be brought into a dry, warm room or shop till it is fit for joiner's work. After it has been wrought it must stand in the shop for a few weeks, until it has assumed the average condition of dryness that is permanently maintained by wood in our moist climate. It may then be finished off. If a round or square piece of wood has to be made thoroughly dry, it is best to bore a hole hrough the heart, so that the air may get access to the interior, and make it keep pace in drying with the outside, so that the shrinkage will be really equal all through. The length of time that has to be occupied by this natural process of drying, with the consequent expense, has induced many inventors to propose the drying of timber by artificial means. The most ancient method is that of drying in the smoke, which would be the smoke of wood fires. Besides drying it more rapidly than could be done by the gentle warmth of a room, the bitter deposit from the smoke was supposed to protect wood from insects. There is an old patent (Langton's) by which the sap is extracted from the green timber in a vacuum cylinder under heat. The length of time occupied and the cost prevents its use. Other systems for the application of considerable heat with the condensation of the extracted moisture are subject to the grave defect of causing irregular shrinkage with splitting of the wood, and though the cracks thus made close again to a great extent, the mischief done to wood that is intended for many important uses is incurable. For the use of the carpenter it is unfortunate that balk timber and deals now seldom get any seasoning beyond the time requisite to convey them from the forest to the building, and the very imperfect seasoning the balks get during their stay in the docks. Such timber, if closed up from the air near to moist walls or new pugging, will quickly develop dry rot, even in the upper floors of a house. Deals should have a year or two of open-air seasoning, being stacked with spaces between them, and should afterward be gradually dried as they are required for use in the joiner's shop. Dry wainscot from Riga and Odessa are cut into thicknesses, and stacked for three, four, or five years, being placed on end, as the sap is supposed to run down more easily. Planks are stacked horizontally, with spaces between them. Such woods as mahogany, black walnut, ash, birch, and maple are treated similarly for a shorter time. In all cases the ends of timber require protection from sun and wind, as they dry more rapidly than the other parts. One of the old methods of seasoning is to keep timber in water for a fortnight after being felled. A good deal of the sap is thus dried out of it, and it becomes more durable, but is not so strong. Steeping it for a longer time injures it, particularly if it is kept floating only partly covered with water. Boiling and steaming timber have long been tried, and the processes have been almost or quite abandoned. The effect will be to wash out the sap as in steeping. A fresh plan of steaming has lately been introduced, and is said by some who have tried it to be efficient, as for many purposes it may very well be. There are many purposes for which the strength of wood is of less consequence than dryness, or at least permanence of the same degree of dryness. The sap has been extracted by the air pump, which must promote dryness; but this plan does not seem to have been much practiced. The ordinary means of drying artifically are various methods of keeping up heat in a drying room, generally by the use of waste steam from machinery. When wood has been cut up into small scantlings, the drying can be hastened in this way; but the further the heat is raised beyond that of an ordinary room the greater is the risk of irregular drying and overdrying.

There is a new process for seasoning boards by means of dry cold air. The air is passed through a furnace, so as to make it dry; it is next cooled, and then made to circulate through the piles of wood, so that in a few hours the boards are dry. One or other of these processes will probably be found so far satisfactory as to be useful for a great variety of purposes. There are no purposes for which wood is used in which the question of seasoning is of more importance than the higher class of cabinet work and the making of musical instruments. The best makers of such articles are exceedingly shy of artificial seasoning.

In organ-building such woods as mahogany, black walnut. birch, red, yellow, and white deal, and a large proportion of pine are used. These are stacked under cover, being carefully packed so that the air has free access through each stack. Hard woods require from two to four years; soft woods from one to two years of this seasoning after being cut to sizes. Even the workshop must not be too warm. The best pianos are made of wood that has been stored, first (as regards the deals) in open stacks protected from sun and the penetration of rain, and finally in rooms where all kinds of wood, cut to sizes, are subject to the very gentle warmth of 70°. The common sense of this question of seasoning is sufficiently obvious. Wood must not be dried so quickly that it will be made unsound by cracks. It must not be dried so much that it will absorb fresh moisture and swell when it comes into the atmosphere in which it has to permanently remain. It is not merely a question of time, but of judgment, the objects being to see that the timber is gradually reduced in scantling as it dries, and so treated as to temperature and stacking that it neither splits nor gets out of shape.

There is very great diversity in the details of different experiments on the loss of weight by seasoning. Oak appears to lose from something less than one-fifth to more than one-fourth of its weight. Other woods vary still more. Teak and pitch-pine lose very little. Woods that come from remote places get seasoned in a great measure before they reach this country. Paints or other appliances that would close up the pores must on no account be put on wood that is not sufficiently seasoned. When dry, they may be serviceable by preventing the absorption of moisture. If the wood is full of sap, decay will take place much quicker when painted than if it were left uncovered.

One of the most important questions, as regards the soft wood especially, is the prevention of decay. When in use in a building, timber generally decays either by rotting, through becoming sodden with wet, or by what is called "dry rot," which is caused by slight moisture, warmth, and want of ventilation. For the prevention of decay the kyanizing process, which consists of the application of corrosive sublimate by soaking, is effectual.

The process of Sir Wm. Burnett is still carried on by the firm established by him at Millwall. It does not seem that very much is required in order to make our resinous woods durable when exposed to the atmosphere. Complete exposure to the air, combined with the dryness of the ordinary atmosphere, is in itself a great preservative. Beech timber is useless in construction, as a building in which it is employed will be destroyed, chiefly through the attacks of insects, in a few years; but beech will last many years as a weather-boarding for such a building. In the Indies, such insects as the white ant destroy all woods that are not bitter, especially soft woods.

When furniture is sent from England, it may be partially protected by a coating of red lead; but if the insects get into the substance, they honeycomb it before any one suspects that they are there. It is, therefore, advisable to impregnate the wood with some protective solution, by means of such machinery as has been mentioned. The essential oils, such as turpentine, have been recommended; but they are inflammable. Corrosive sublimate, arsenic, and other poisonous solutions of that class seem most suitable. Creosoting is effectual both as against decay and against insects, but it spoils timber for all of the best and finest purposes. The protection of wood from fire is a most important question, particularly as recent experience seems to show that we cannot depend upon iron or stone. A heavy wooden beam will resist fire longer than any other beam or girder. The same with staircases. Such liquids as tungstate of soda could be forced into the substance of all wood used where fire is to be guarded against. Outward applications seem to be effectual in experiments tried on a small scale. To sum up the whole class of questions connected with seasoning, we want timber that will not shrink after it is brought into use, that will not warp or twist out of shape, will not decay through damp, and will not be destroyed by insects.

Wood may also be indurated, that being the result of polishing and of varnishing to some extent. Upon the whole, it is desirable to encourage all means of treating wood so that it may possess some of the advantages that are commonly attributed to iron and stone. In cutting up timber for use, the question of its grain as developed by the annual rings is of very great importance. The shrinkage being greater in the newer layers of wood, it must be cut so that this irregular shrinkage may be of no disadvantage in use.

* From a lecture recently delivered at Carpenters' Hall, London.

A plank taken out of the middle of a log will shrink at its sides more than in the middle; the boards that are cut out to right and left of this plank will curl outward from the center of the log. If a log is cut into four quarters, the part of each quarter that is furthest from the center will shrink the most. Nothing requires such care in converting as oak timber, in which the medullary rays have so much influence. In order to show the beauty of the grain, as well as to provide wainscot boards that will be true in shape, it is necessary to get the boards as far as possible to radiate from the center to the outside of the log. If this is done, the medullary rays are cut through in many places, so as to show the silver grain.

One method for doing this perfectly is shown in books, though I never heard of its being done in practice, the great expense and waste in sawing being an effectual obstacle. I have always had English oak "quartered," and then the boards have been sawn from alternate sides of each quarter—a method which insures at least eight perfect boards, and at least twice as many very good ones in regard of beauty of grain.

Wainscot oak from Riga and Odessa comes to this country with two slabs taken off the opposite sides, and a cut clean through the center, or else it has the slabs taken off and a plank taken out of the middle. When it is partly seasoned, the plank has the center part taken out, as the part around the pith is likely to be unsound. Then each of the side logs is cut up into boards, several of which will go pretty nearly along the line of the medullary rays, and show the silver grain.

Oak timber, as it was used in the beautiful Gothic timber roofs of the middle ages, and as it is still used in important parts of wooden ships, requires to be not straight, but bent. This bent timber is known as "compass" timber when it is 5 in. and upward out of the straight in a length of 12 ft., and is more valued on that account.

Ash timber does not appear to have any sapwood, all the wood being of the same color, and there are foreign timbers with the same peculiarity. It appears, however, that the worm finds out the part that is sapwood, so that it has the usual defect. In elm timber the sap is reckoned as good as the heart. The timber does not improve by seasoning, but should be used green, and even kept wet until wanted for use. When used in flooring, I have known the oldest elm boards shrink considerably if they were merely taken up and planed.

We must not overlook the important uses of the finer kinds of wood when cut up as veneer. The fact that veneer is very much abused is no argument against its legitimate use. It should only be used in panels, so that the framing will be of solid wood of good plain colors, to set off the beauty of the panels. The most beautiful veneers are still cut with the saw about ten to sixteen to the inch, though knife-cut veneers are very largely used. By steaming large logs of timber and putting them in a lathe, the knife will pare off a continuous sheet from the thirtieth to the one-hundredth part of an inch.

The chief woods used are rosewood, zebrawood, satinwood, tulipwood, mottled mahogany, walnut burrs, bird's-eye maple, birch, Hungarian ash, and sycamore, and there is a great variety of beautiful colonial and American woods producing every variety of color.

DESIGN FOR CHURCH AT WEST HERRINGTON.—Mr. A Hessell Tiltman, A.R.I.B.A., Architect.

CHURCH AT FRANKFURT.

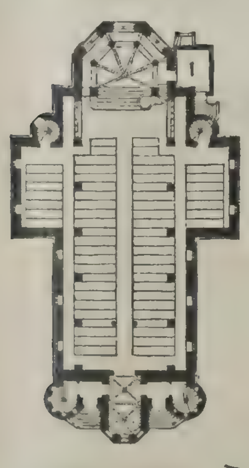
Christ Church, in Frankfurt a. M.; built by A. Von Kaufmann, architect, of the above mentioned city.

Christ Church was founded by Mr. Moritz Bernus, was built in the west end of the city, in 1883. As in the modern English churches, the six hundred seats are placed on the floor of the church in the nave and transepts; the choir is arranged for the accommodation of the singers only, the organ being placed in a part of the building constructed next to the choir, specially for its reception.

The principal entrances are in the tower, some, which serve also as porte-cocheres, being on one side, and others, for pedestrians, being on the other side.

The outer surfaces of the walls are of hewn Bockenheim basalt, and the quoins, lintels, sills and sill courses are of green sandstone, from the valley of the Alsen.

The entire cost of the church, including the furniture, but exclusive of the clock and organ, was 130,000 m. or about $31,000.—*Architektonische Rundschau.*



CHURCH AT FRANKFURT.—By A. v. Kauffmann, Architect.

DESIGN FOR A CHURCH.

The accompanying design was made for a proposed new church at West Herrington, near Durham, by A. Hessell Tiltman, London. The accommodation is for 500 persons, and consists of nave, two aisles, chancel, and the usual vestries. The material proposed to be employed was local stone with slate roofs.—*B. and E. Times.*

EARTH CURRENTS IN THE BEN NEVIS OBSERVATORY TELEGRAPH CABLE.

At the last meeting of the Royal Society, of Edinburgh, a most interesting and suggestive paper on the above subject, by Mr. H. N. Dickson, was read by Professor Chrystal. Disturbance of the telegraphic instruments at the observatory by earth currents had frequently been observed, and the inference drawn from the disturbances was that the currents always existed, though with varying degrees of strength. Extending from about the middle of September till about the middle of October, 1885, a series of careful observations were made, with the view of determining, if possible, how far the disturbances were regular. By means of a galvanometer inserted in the telegraphic circuit, observations were taken every hour, and the results appeared to show that from midnight till four o'clock A.M. there was an earth current passing up the mountain, and reaching its first maximum about two A.M. This was then followed by a slight return current down the line till about five o'clock, when a strong current up the line set in, which reached its maximum for the day at ten o'clock forenoon, and its minimum

SKETCH FOR A COUNTRY CHURCH.

at one P.M. Subsequently the current increased pretty rapidly down the line again till three P.M., and became rather unsteady during the next five hours. Then an uphill current steadily set in again, increasing till nine o'clock, and reaching it minimum at eleven P.M. While these observations were in progress, the summit of Ben Nevis was almost continuously enveloped in storm and mist, and by this the results were, to some extent, necessarily affected. When the top of the mountain was clear, it was observed that there was a strong current passing up the cable, the current being reversed when the opposite condition of things prevailed. The current was always found to be down the line during a fall of snow. In the opinion of Professor Chrystal, these results opened up an interesting field in electrical science, which could only be thoroughly investigated by help from Government. One thing required would be to obtain possession of a land line to make experiments as to the effect of earth currents along the horizontals. Mr. Sang said that the results detailed in the paper materially affected the results of the determination of the earth's density by means of a plummet. The deviation of the plummet on which those results were based might be caused entirely, he thought, by the presence of the currents spoken of.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information, and not for publication.
References to former articles or answers should give date of paper and page or number of question.
Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all, either by letter or in this department, each must take his turn.
Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.
Scientific American Supplements referred to may be had at the office. Price 10 cents each.
Books referred to promptly supplied on receipt of price.
Minerals sent for examination should be distinctly marked or labeled.

(1) W. T. S. asks: How many feet board measure, allowing ¼ of an inch for the kerf of the saw, in a stick of timber 48 feet long, 10 inches by 10 inches square? A. If you sell the stick of timber at board measure, no allowance should be made for resawing, and it should tally 400 feet board measure. If allowance is agreed to for resawing, the stick will cut seven 1 inch boards and one 1¼ inch board or plank, and should then tally for the whole stick 330 feet board measure.

(2) C. M. asks: 1. What can be used to render new patches in an old brick wall similar in appearance to the old? A. We know of no means of accomplishing such result. 2. I have seen something like a charcoal stick, which when burning at one end would cut glass. What is its composition and how is it made? A. Take sticks of soft wood (willow or poplar) of about the thickness of a finger, which must be thoroughly dry, immerse for about a week in a concentrated solution of lead acetate and then dry. See also "Simple Method of Cutting Glass," in SCIENTIFIC AMERICAN for October 31, 1885, page 275.

(3) J. H. B. asks: What size engine and boiler will run a boat 22 feet long, 5 feet beam, and 3 feet deep, at speed of 9 miles or more an hour? A. 3×4 cylinder; vertical boiler, 26 inches diameter, 45 inches high; 20 inch wheel, 36 inches pitch.

(4) S. F. L.—Your 1 horse power engine will run a light 18 foot boat with a good form of 3 blade propeller, 16 inches in diameter. Would not recommend a paddle wheel for so small a boat. We advise you to inspect the numerous small steam yachts in your vicinity.

(5) W. S. L.—It will take 6 horse power for machines you mention. We could not in Notes give large examples and details.

(6) G. J. S.—Sheet copper is somewhat variable in its tensile strength; hard rolled copper 36,000 pounds, soft copper 24,000 pounds, is the utmost strength per square inch. Thus a $\frac{1}{32}$ inch sheet will tear asunder at from 750 to 1,100 pounds per inch width. Allow ¼ of this as a safe load. To make sure, say 200 pounds, which divide by the pressure you wish to carry. Gas pipe will stand 500 to 1,000 pounds pressure.

(7) G. J. E. asks: How can I dilute crude carbolic acid with water? I have not been able to mix it thoroughly. A. Carbolic acid is soluble in 15 parts of water, therefore you cannot expect to make a very satisfactory solution except by using large quantities of water. Heat will facilitate the solution somewhat, but alcohol, ether, and acetic acid are the best solvents.

(8) J. B. W.—Pure water will not affect flues or boiler. If you are using a surface condenser, you are probably pumping oil into the boiler, which may contain acid that will act on the boiler. There is no acid from the brass tubes.

(9) D. & S.—Broken anthracite measures 45 cubic feet to a gross ton, or 50 pounds to the cubic foot, but the specific gravity of anthracite varies from 1·350 to 1·640, or from 84 to 102 pounds per solid cubic foot, so that there will be a variation of from 2 to 3 pounds to the cubic foot as above stated for various kinds of coal.

(10) H. M. B. desires a formula of plastic compounds that soften easily by gentle heat, and are easily worked into shape and position by gentle pressure, and will then set rapidly. A. The following mixture, used for making photo. gelatine plates, may be applicable: 70 parts of bitumen are melted at a moderate heat, and to the melted bitumen there are added the following, each being melted previously: 425 of spermaceti, 200 of stearine, and 170 of white wax. All these being incorporated, 70 parts of finely ground black lead are stirred in. This preparation is poured over plates at a temperature of about 40° Centigrade.

(11) L. H. writes: A man who has had considerable to do with steam engines and boilers, as fireman and engineer, asserts that it requires more water (more pumping at least) to run an engine when the atmosphere is charged with vapor and the barometer low than at other times. He states that the experience of other engineers and firemen of his acquaintance agrees with his own in this matter. Is it probably true, if so, how explained? A. It is probably not true. The barometric variations in the density of the atmosphere may make a very slight difference in the pressure gauge reading, and also in the action of the fire. Low barometer with saturated air also effects the draught and combustion.

(12) B. M. W.—The gas which escapes from the earth in the localities of natural gas wells is supposed to have been generated by the internal heat of the earth, and confined to the porous or cavernous lower strata of rocks by a later deposit and hardening of a close grained upper strata. There is a possibility of a slight depression of the earth's surface in the oil and gas region, unless the percolation of water should in a measure counteract it. The depth at which the gas cavities are tapped is equal to a water pressure from the surface of several hundred pounds to the square inch. The thickness of the solid crust of the earth is probably from 50 to 75 miles, although there is room for a variety of hypotheses on this point.

(13) W. L. R. desires (1) a recipe for making varnish black, such as used on iron work, like sewing machines. A. Such work is japanned, not varnished. See SUPPLEMENT, No. 316, on process. 2. What kind of acid is used for testing gold, how is it used, and how will it act? A. Test with nitric acid. It will have no effect on gold, but readily dissolves other metals.

(14) J. N. C. desires the formula for making the "walnut hair dye." A. The simplest form is the expressed juice of the bark or shell of green walnuts. To preserve the juice, a little alcohol is commonly added to it with a few bruised cloves, and the whole digested together, with occasional agitation, for a week or fortnight, when the clear portion is decanted and, if necessary, filtered. Sometimes a little common salt is added with the same intention. It should be kept in a cool place. The most convenient way of application is by means of a sponge.

(15) W. F. R. asks: 1. What material is the best to paint a tin roof? A. Prince's metallic paint and boiled linseed oil. 2. How can I make human manure into a fertilizer? A. By mixing with dry soil. 3. What is the best plan to build a private icehouse—above or below ground? Give me the best plan for both. A. Below ground, all but roof. See SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 59, 55, 99. 4. I have two large skylight glasses that are cracked across. What can I use to stop them from leaking? A. Putty a strip over the cracks, or put in a new light. 5. What is the best soldering fluid to use on an old tin roof, that has been painted with tar? A. Tinner's acid, zinc dissolved in hydrochloric acid, and add a little sal ammoniac. Scrape the tin where you intend soldering. If at all possible, use rosin, as it makes a better job than acid. 6. How can I make whitewash that will not rub off? A. Put a little white glue in the whitewash. 7. What is the name of the best brand of tin that is made? A. There are over three hundred brands in the tin trade; generally, the more letters, as X, XX, XXX, etc., the thicker the tin.

(16) F. A. T. asks for any means to prevent hands from perspiring. A. Use the following prescription:

℞. Acid tannic........ ℈ ij.
Aqua rosal........ ℥ ss.
Spt. Vin. Rect........ ℥ iiss.
Aquae........ ℥ iij.

M. S. Use as a wash, each night and morning with a soft sponge. The skin should be thoroughly cleansed with soap and warm water and carefully dried and then apply the wash as directed.

(17) J. P. E. writes: I have been troubled for over a year with pimples on my face, what can I do to get rid of them? I have been taking medicines for nearly three months and find no change. A. The pimples are probably an affection known as acne. They are of no consequence except for the unsightly appearance which they cause. They are exceedingly common among young people, and almost invariably cease to show themselves, at the age of 20 to 22. Medicines have of course been tried in every available form both external and internal, for the beauty of a smooth skin is too universally prized to allow any neglect of care. But they are of very little service, as the best authorities all agree. Remedies are advertised continually; have nothing to do with them; they will do you no good, and may, on the contrary, injure the skin seriously.

NEW BOOKS AND PUBLICATIONS.

ARTISTIC HOUSES IN CITY AND COUNTRY. By Albert W. Fuller. Boston: Ticknor & Company, 1886.

This series of thirty-six designs, varying in cost from two to fifty-thousand dollars, merits in a marked degree its title of "Artistic Homes," for all of the houses, or at least a very large majority of them, are thoroughly pleasing. They form an agreeable study for either the professional architect or the cultivated householder. While many of the designs were prepared to satisfy special conditions, and, as Mr. Fuller remarks, are not therefore adapted for general application, still they form an admirable basis for such modifications as each builder and site require. Many of the plates are from photographs of the houses themselves, reproduced by the heliotype process, and are consequently free from the uncertainties more or less attached to paper houses. The free-hand sketches of both exterior and interior views are pleasantly suggestive. A special element in the larger designs is the careful study made of the tower. Mr. Fuller has succeeded in making an attractive feature out of what in less skillful hands is often a serious blemish in an otherwise satisfactory structure. William Pretyman has given a few hints on decoration, and Richard Prescott on sanitary arrangements

BUILDER'S WORK AND THE BUILDING TRADES. By Col. H. C. Seddon, R.E. London: The Rivingtons, Waterloo Place; Philadelphia: The J. B. Lippincott Co.

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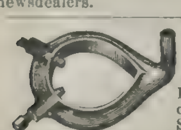

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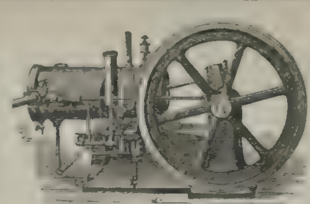

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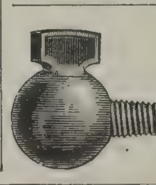

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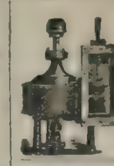

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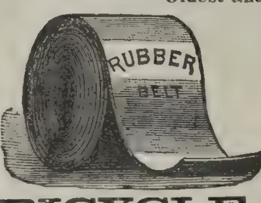

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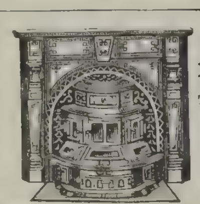

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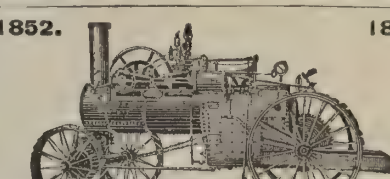

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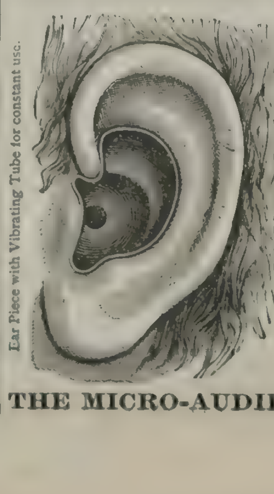

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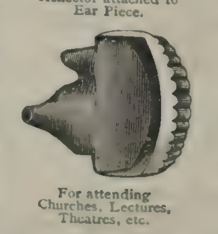

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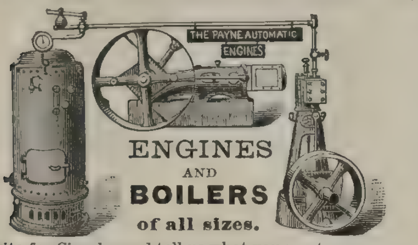

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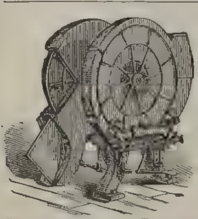

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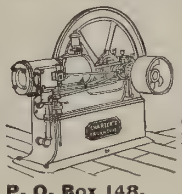

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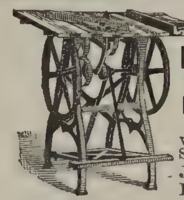

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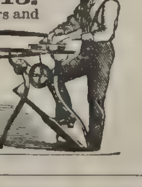

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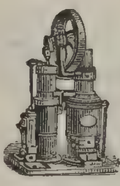

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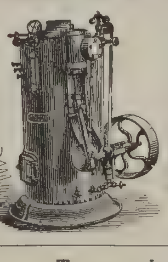

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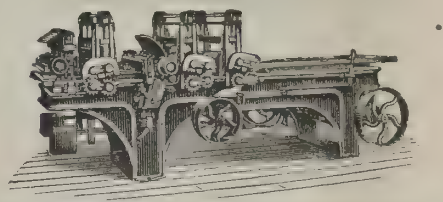

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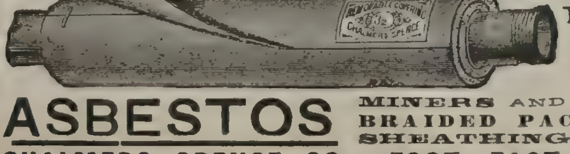

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Figures preceded by a *star* (*) refer to illustrated articles.

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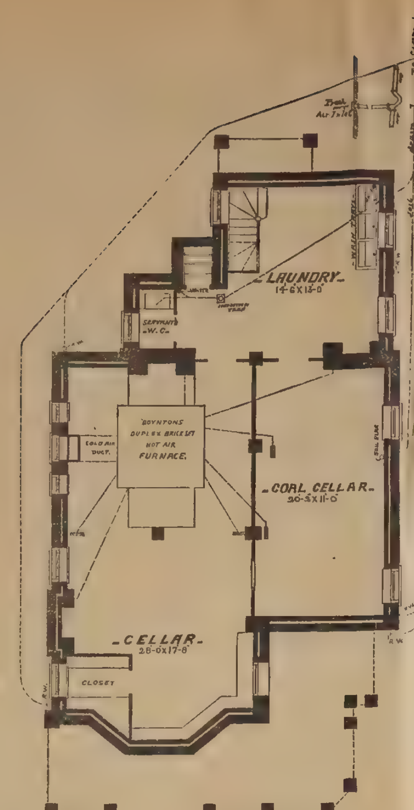
—STAIRS DETAILS—

—SCALE, ¾ inch = 1 foot—



Cellar Plan

Plans, Elevations, and Details for a Country House.

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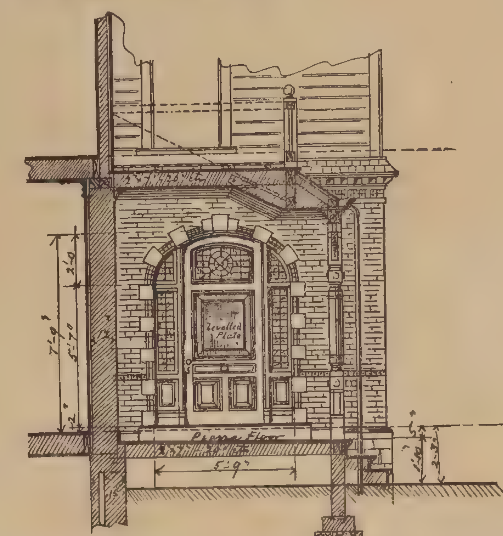
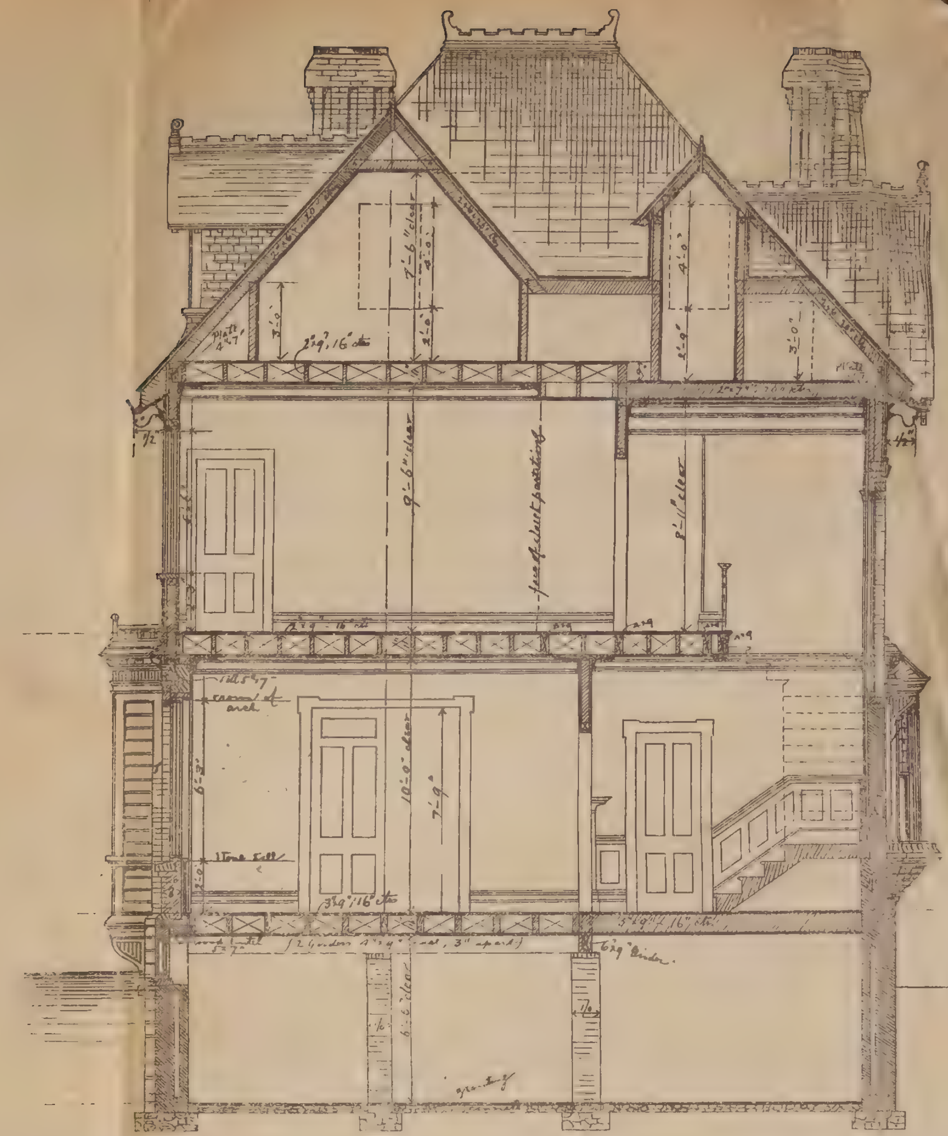
Attic Floor Plan



Section thro' Piazza showing Front Door.



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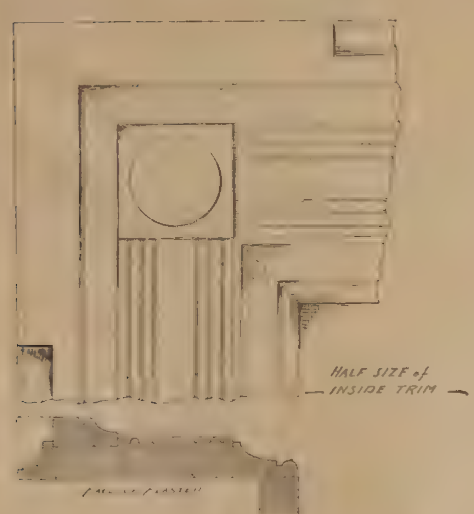

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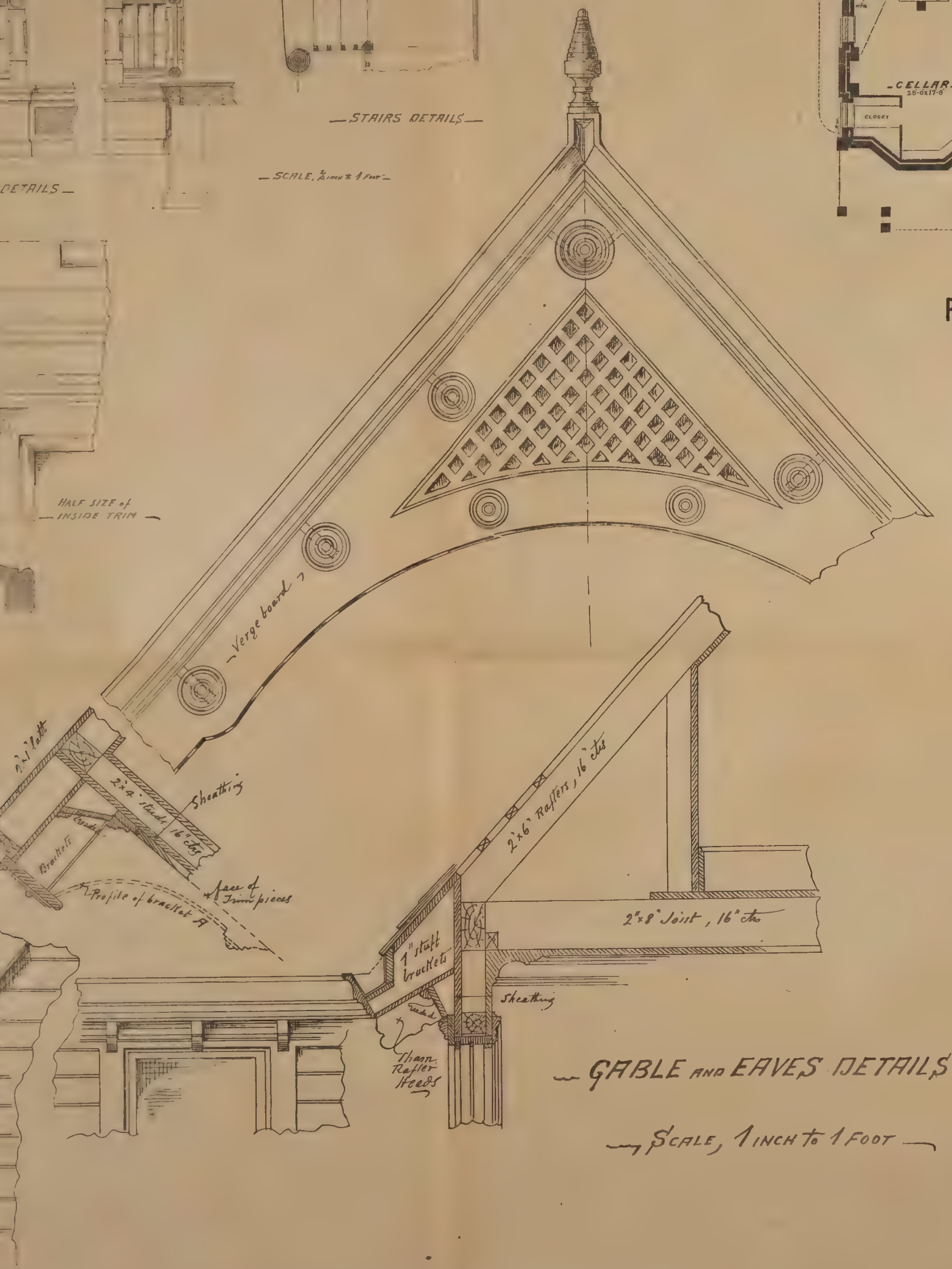
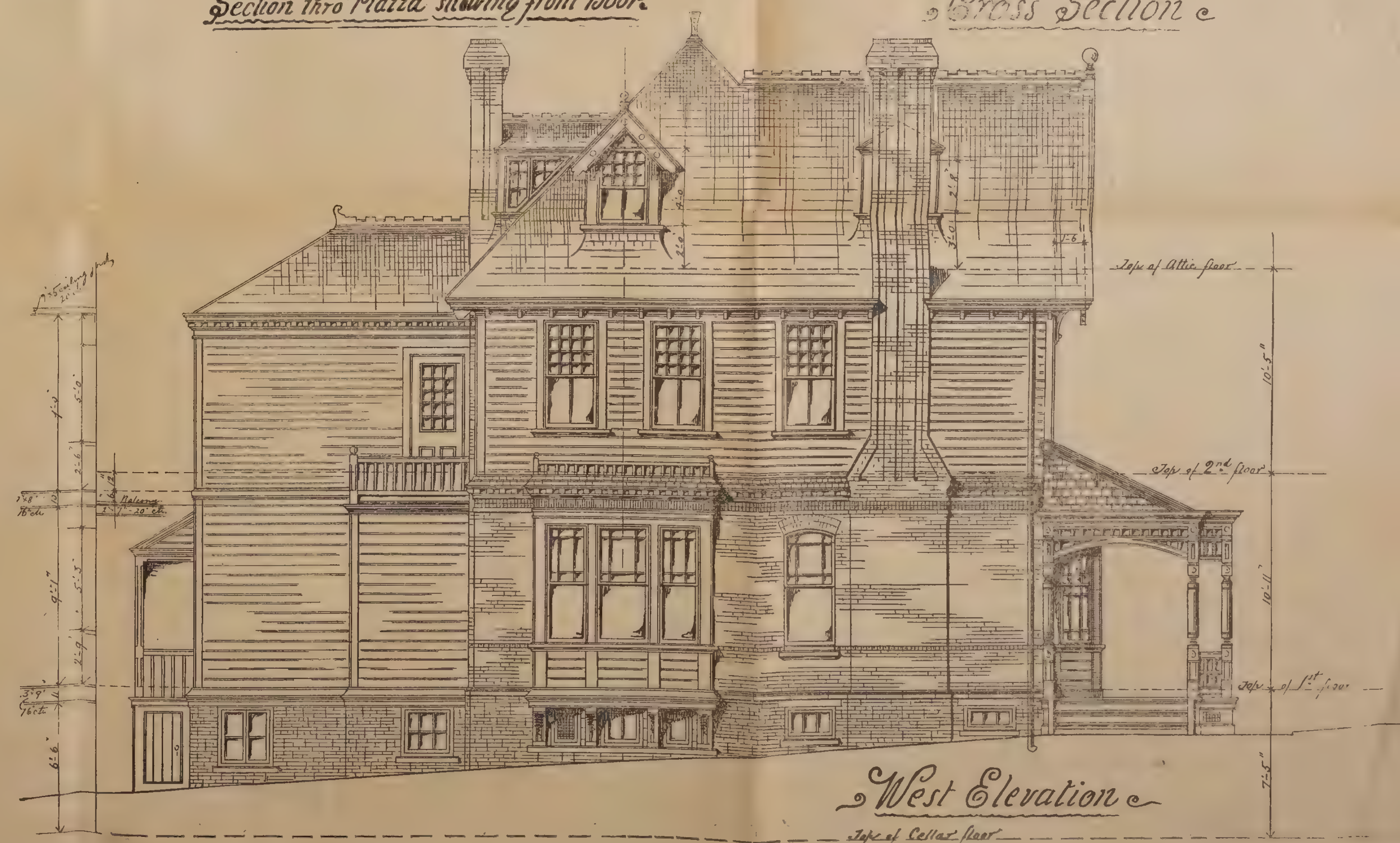


—GABLE AND EAVES DETAILS

—SCALE, 1 INCH to 1 FOOT—



West Elevation

Details to accompany Colored Plates. For description see Architects and Builders Edition of Scientific American for June, 1886.